

RICE UNIVERSITY

**Compound Field
The Objectization of Vectors**

by

Jinge Chai

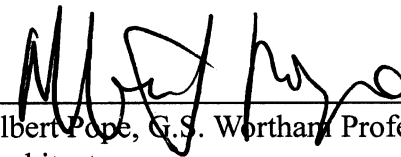
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Master of Architecture


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ABSTRACT

Compound Field The Objectization of Vectors

by

Jinge Chai

This thesis explores the intermediate situation between vector field and object field. With careful study of precedents, both vector field and object field are found to have their certain limits in complex urban environment, an alternative field concept, compound field, is proposed. Compound field is constituted by compound hybridization between objects and vectors, in which objects and vectors mutually interact with each other.

Theoretically, compound field can be created through vectorization of objects, or objectization of vectors, but the thesis project only focus on the latter. A museum complex, which is vaguely defined in actual functions, is designed follow the objectization operations, based on the vectors generated from its dynamic site, which is located by the waterfront of Seattle. The development starts from the analysis of site vectors, different transportations, circulations, contextual relationships and hidden forces are learned and processed digitally; then these vectors are objectized through three major operations, thickening, faceting, and profiling, in which the objectivity is built up without sacrifice of their vectoriality; then, joints typology, vectorial sensations, combination of archetypes and spacial organizations are studied for the building complex; at last, drawings, and renderings are represented in an analytical way, in order to point the space sensations back to its shaping forces. The ultimate goal is an architecture with no priori or posteriori, it is architecture itself appears prior to its vocabulary or its parts.

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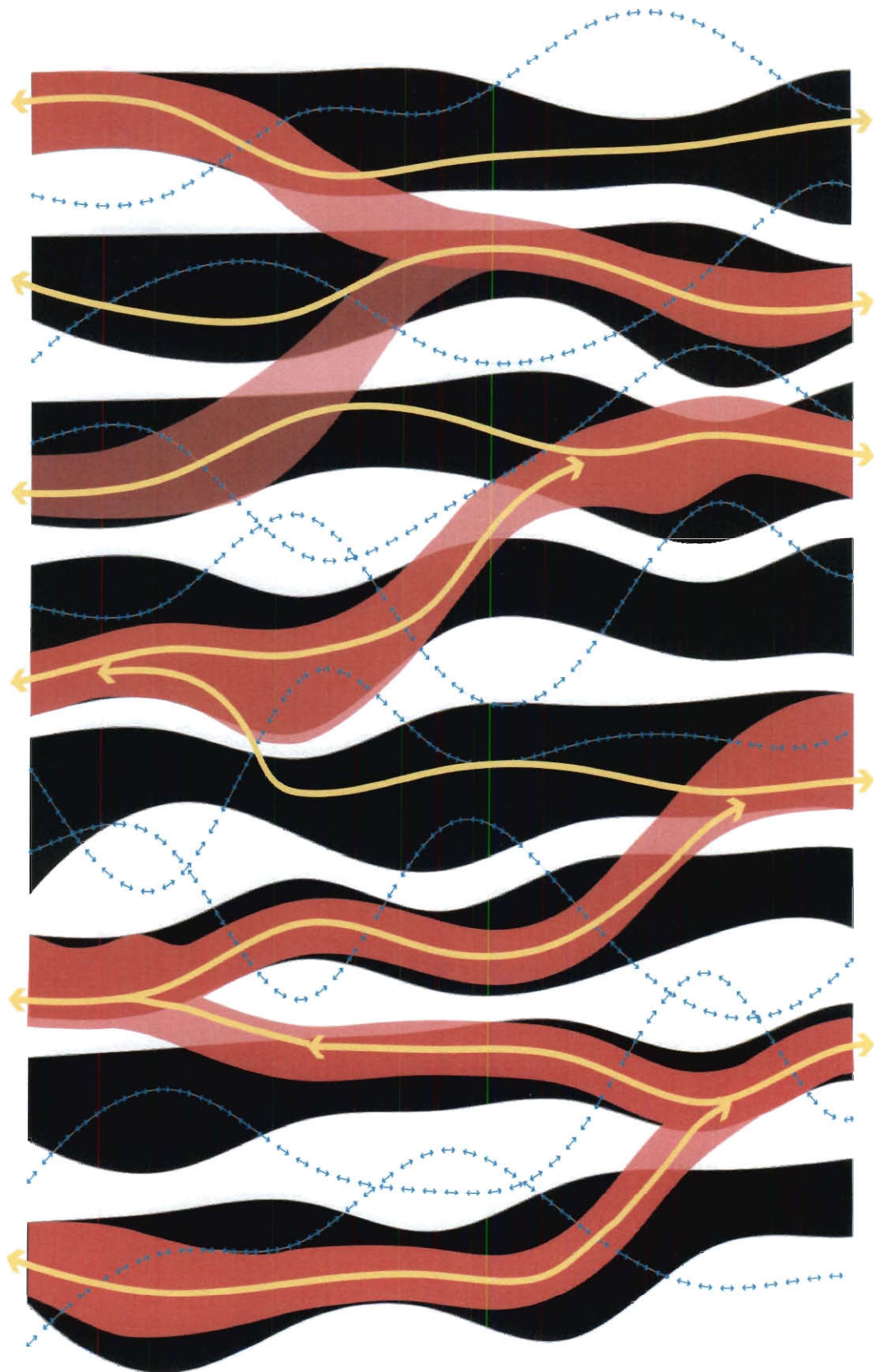
To Brantley, Marti, Andres, Tracy, Rebecca, Jessica, Duncan, for their help before my final, I almost messed it up, you all are my savior.

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Compound Field: The Objectization of Vectors

PREFACE

In the world of science, there is an ancient tradition of searching for TOE, Theory of Everything. From Aristotle to Newton, from Newton to Einstein, all these geniuses have been trying to unify all the major scientific theories under one function. Recently, the cutting-edge string theory unified all the basic particles with vibration strings in eleven dimensional space. The universe is a huge field built by strings, tolerate to any differences and change. But this is still a hypothesis, they are still on their way.

Then how about architecture? Architecture can be such a simple thing, but can also be so much more complicated, compared with science. Maybe it's still too far away for an architecture student to pursue a TOE in architecture, but there are certainly ways of thinking that can tolerably unite two counterparts of a discourse.

Think about all those slogans, "less is more", "less is bore", "yes is more", or "form follows function" and "form is function", there are always such fightings between two sides. Is it really so important to choose left bank or right bank? I believe it is more important to learn both sides of the discourse, and then unify them dialectically.

The discourse for this thesis is "FIELD"; the two sides are vectors and objects. In this thesis, the world is a field, a COMPOUND one.

INTRODUCTION

This thesis is a research of methodology on architectural design. By aiming at the ambiguous compound between objects and vectors, it does not mean to create spectacular forms, but tries to provide another way of thinking. Therefore, the trace of the thoughts and the development of the theory are as important as the actual design process.

The thesis include two parts. The pre-thesis research is included as the first part, and a crucial part for understanding the thesis' main title, "compound field", because the analysis and critic of the precedents contribute greatly to the development of the proposed compound field. The ambition is to think large, to create a ideal formation for the architectural world.

The second part is the design project, which is an application of the proposed "compound field" methodology. The theory built up in the first part in narrowed down and modified for this specific project, to provide a typical instance for this methodology. While the actual functions of the building are open to further researches, the design process is articulated graphically with clear developing orders.

FIELD RESEARCH

Field is an important topic of the architectural discourse, it is a condition always existed in architecture and city. However, only recently, in the late 20th century, the concept of field in architecture is specifically theorized and becomes popular in both academic research and practice, when people's view of world has greatly changed under the influence of the cutting-edge scientific discoveries.

Human's recognition of the universe can be divided as three phases. At first, earth was considered to be the center of the universe, according to the predominant Ptolemaic Geocentric theory, which is deeply related with the Euclidean mathematics. Based on these basic scientific views, architecture is all about idealized geometry and shapes, space is considered as solid objects.

When Newton published his gravitational rules, the Cartesian coordinate system had become the guide of science, accurate calculation of movement and energy became available, people start to understand solar system, and all kinds of complicated but predictable systems. Corbusier's earlier planning works still belong to this phase, they are accurately organized mass projects.

In the 20th century, Einstein's Principle of Relativity first time combined space with time and independent space from object, later the Quantum Mechanics totally departs from Classic Mechanics and describes the atomic and sub-atomic scale by quanta and probability. As products of new physics discoveries, Lorentz Transformation and Mass Energy Equivalence started to be widely used in Math-

View of World and Scientific Discoveries

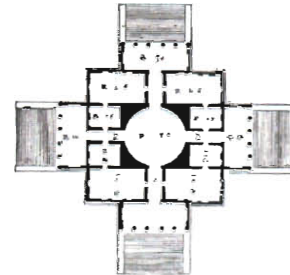
Ptolemaic Model



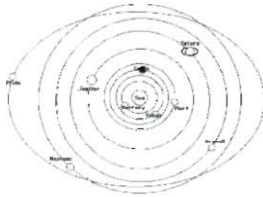
Euclidean Ideal



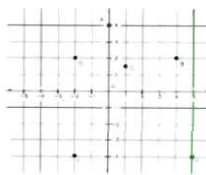
Objects



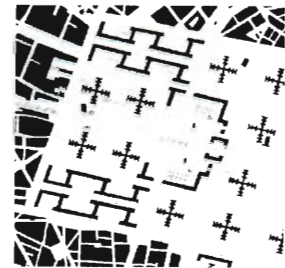
Newton Gravity



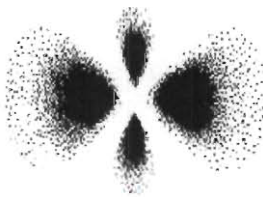
Cartesian Coordinate



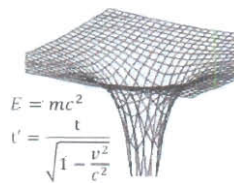
Mass Objects



Einstein Relativity
& Quantum Mechanics



Lorentz Transformation
& Mass Energy Equivalence



Field



ematics. All these new theories expanded people's world view to a new level, in which the universe is generally and comprehensively described by fields, quantum field, space-time field, electromagnetic field, and gravitational field... According to Einstein, the field emerges as "an irreducible element of physical description, irreducible in the same sense as the concept of matter in the theory of Newton. Simultaneously, the part-to-whole relationship is challenged and modified in philosophy and art. In contemporary architecture, the similar field conditions starts to be studied and applied by some scholars. Two of the typical pioneers are Sanford Kwinter and Stan Allen.

Introduction to Field, “New Plasticity“, Sanford Kwinter, 1986

(The matrix and description of the last page is mainly inspired by this essay.)

“The field describes a space of propagation, of effects. It contains no matter or material points, rather functions, vectors and speeds. It describes local relations of difference within fields of celerity, transmission or of careering points.”. In Sanford Kwinter’s book “Architecture of Time“, he concludes the development of science and its influence on art and architecture: euclidean mathematics refers to nothing more than idealized solid body; Cartesian ordination system made accurate calculation expressible; Relativity and Quantum mechanics finally create a field theory of empty space, which make it “possible to express the principles of immanence, dynamism and continuity.”

“Field Conditions”, Stan Allen, 1996

By quoting Kwinter’s ‘field definition’, Stan Allen proposes a way of walking out of the Cubism of moderns and the collage of the Post-Moderns. “Field conditions move from the one toward the many, from individuals to collectives, form objects to fields“. He argues that the field fundamentally challenges the part-to-whole logics that determine classical, modern and post-modern composition.

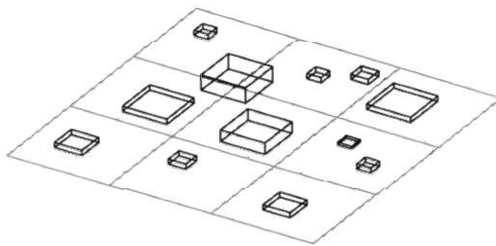
Stan Allen used to typical field instances in architecture to compare with the classic western geometric ideal, the Great Mosque of Cordoba in Spain and Corbusier’s unfinished Venice Hospital, in which the overall form is based on repeated self-same parts and locally established relationships. He also advances his argument by introducing the moiré effect, which can thicken the 2D surface into unpredictable patterns and spacial possibilities in a bottom-up way. However, the effects are not random, it is an order tolerant to chaos, it is a organized system tolerate to change and accident, it is an architecture tolerate to uncertainty. Based on Stan Allen’s instances for field conditions, further research is started.

Field Typology: Objects and Vectors

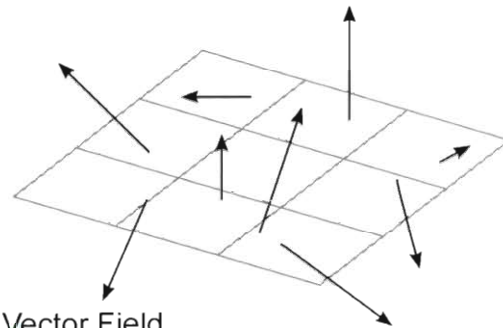
Though Sanford Kwinter's definition for field is purely based on vector, it is more practical to include objects in architectural field. Stan Allen's diagram instances for field conditions can be approximately categorized as two large types, field of objects and field of vectors. These two types can be compared and studied.

The Object Field is constituted by volumetric masses and spaces, solids and voids; (all of them are considered as general objects in object field).

The Vector Field is composed by vectorial lines, either of physical forces or virtual relationships



Object Field



Vector Field



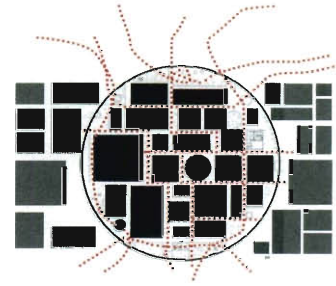
selected instances from Stan Allen's "Field Conditions"

Object Field Case Study 1:

SANAA, 21st Century Museum of Contemporary Art, Kanazawa, Ishikawa, Japan

Compare: Mies Van Der Rohe, Ludwig, IIT Campus

Plan, Chicago 1940



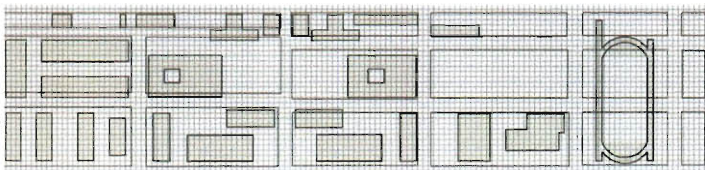
The 21st Century Museum at Kanazawa is a typical object field in contemporary practice. In this project SANAA fragments the exhibition area into several galleries based on 10'x10' grid, and then embeds them in a large circular transparent envelope. In this way, they create a open and versatile museum, which allows different organization happen in different events.

If we look back to the IIT campus plan, it's easy to find it a primitive precedent of field in modern architecture. The plan was operated on the famous 24'*24' grid, which is based on the scale of a room, accommodating all three types of activities.

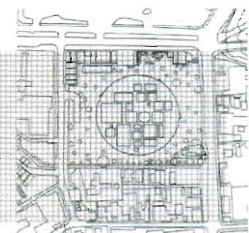
Since both projects are based on orthogonal grids, I juxtapose both projects and use one 10'x10' grid to cover their site plans, then also put Crown Hall and the interior of the SANAA's museum under a smaller grid. Apparently, they are similar object fields, if not considering the circular envelop.

In such kind of object field, the system is classically static, which only provides connections, but not suggests motions, while the adjacent spaces are still divided in a classical way;

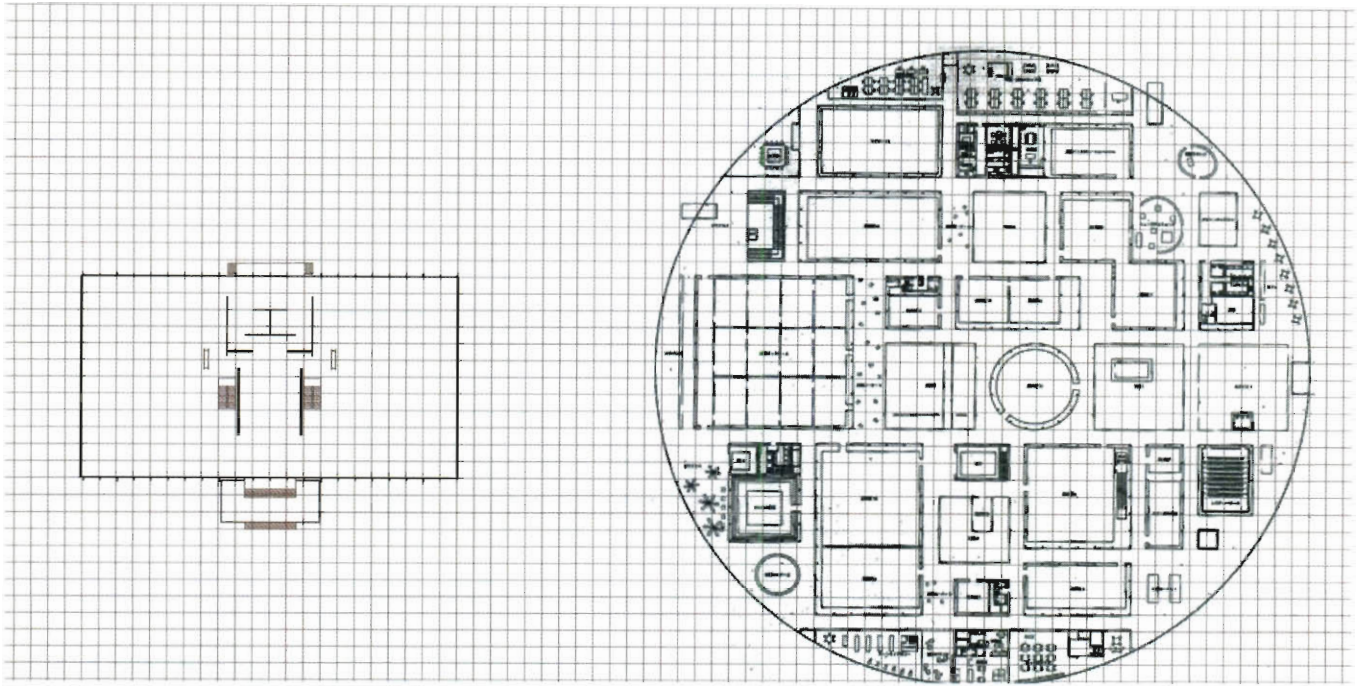
The system is still figure-ground organized, though the latter adds another layer of "gray space". The top right diagram shows how the property of object field is intact with just a circular envelop.



Site Plan of Crown Hall, grid scale is 24'

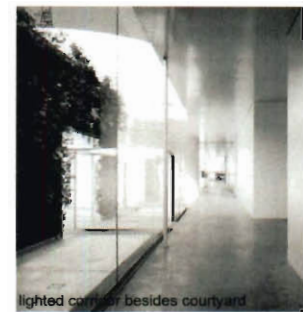


Site Plan of 21st Century Museum, grid scale is 24'



Plan of Crwon Hall, grid unit is 10 ft

Plan of 21st Museum of Contemporary Art, grid unit is 10 ft



lighted corridor besides courtyard



central corridor in between rooms

Compare the interior of both projects, characters of object field can be easily read. In the SANAA museum, the lightness and openness only exist in the outer perimeter of the interior, in the central part, the corridors are long and monotonic.

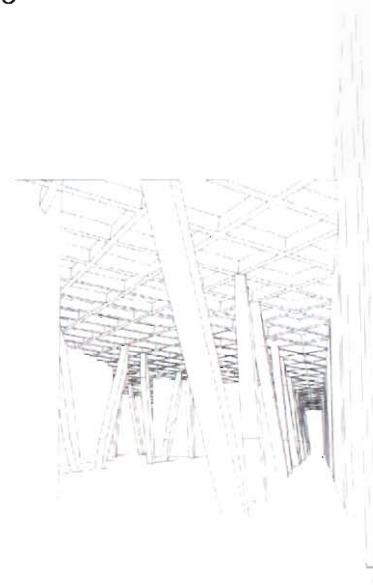
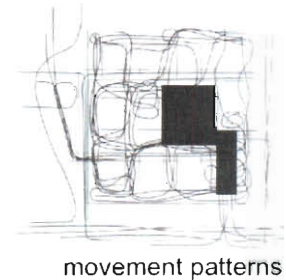
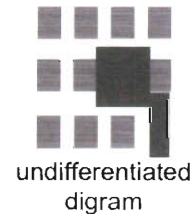
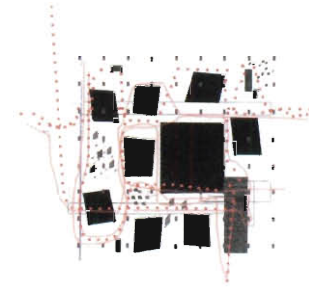
Object Field Case Study 2:

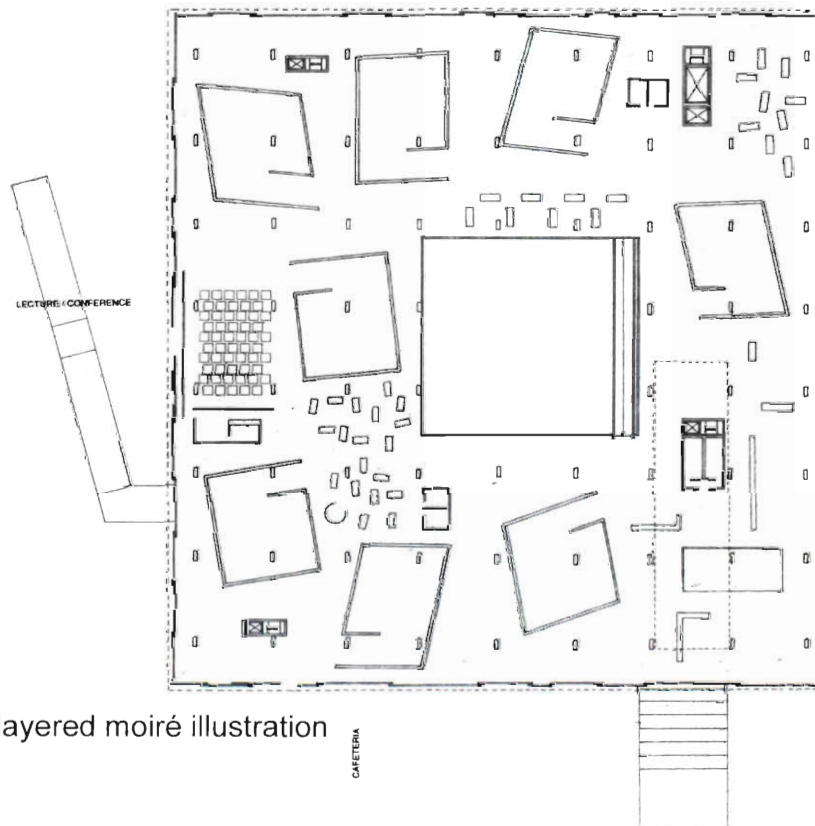
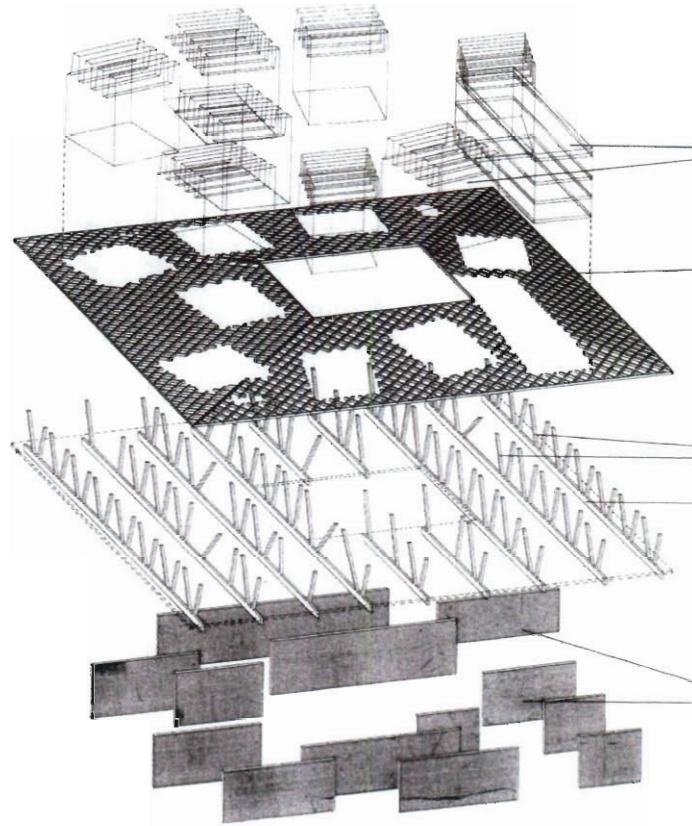
*Korean American Museum of Art, Los Angeles,
Competition entry, 1997*

Stan Allen practiced his own field moiré in this project. He overlays several layers of objects fields, including exhibition boxes, walls, structural frames, ceiling surfaces together.

With variations of different objects and several layers of fields, the field characteristics is more obvious than the single-layer field. In both plan and perspectives, the field quality are clearly articulated. What is more, in his diagram, a complex vector field of circulation lines is added, but it's subordinate to the objects.

However, The system is still a static object field. Since the parts are treated as more or less equivalent, object field belongs to the lowest organization level of fields, lacking motion and positive connections. This kind of multi-layered moiré field, is actually another version of figure-ground patterns.





multi-layered moiré illustration

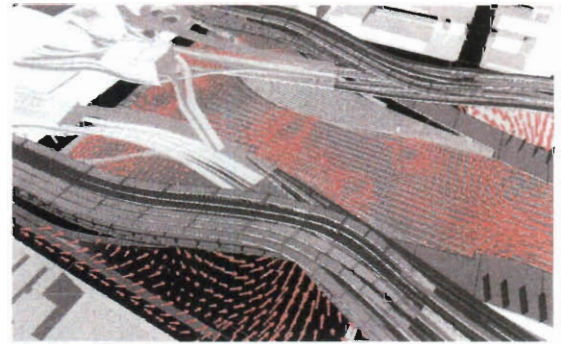
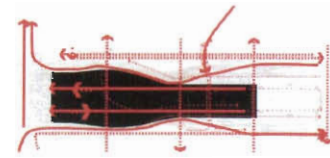
Vector Field Case Study 1:

West Side Convergence, Competition Entry, Manhattan 1999, Reiser+Umemoto, New York

In this instance the urban forms are not characterized by static, isolated objects, but are rather conditioned by a vector field of flows that both influence and promulgate the material organization of the project.

The project can present some infrastructural architecture projects, which rearrange the infrastructural vectors, making the transportation more efficient by intertwining viaducts. But these efficiencies are for drivers, once people get off of their vehicles, they can only see a big surface, a big shed.

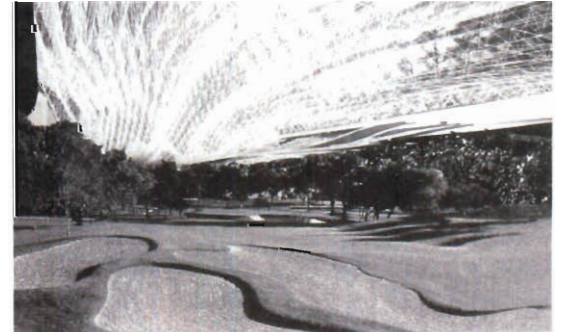
However, once the big surface is generated, the vectors start to be forgotten, or at least weakened, which can be proved by the renderings to the right. The roof becomes a huge shed, an universal whole, which covers the plaza, covers the golf court, covers parking lots, covers everything... it covers everything. Thus, it covers nothing with a super complicated structure. It lose the characteristics as a vector field. People can't feel the vectors, except for those preexisted ones.



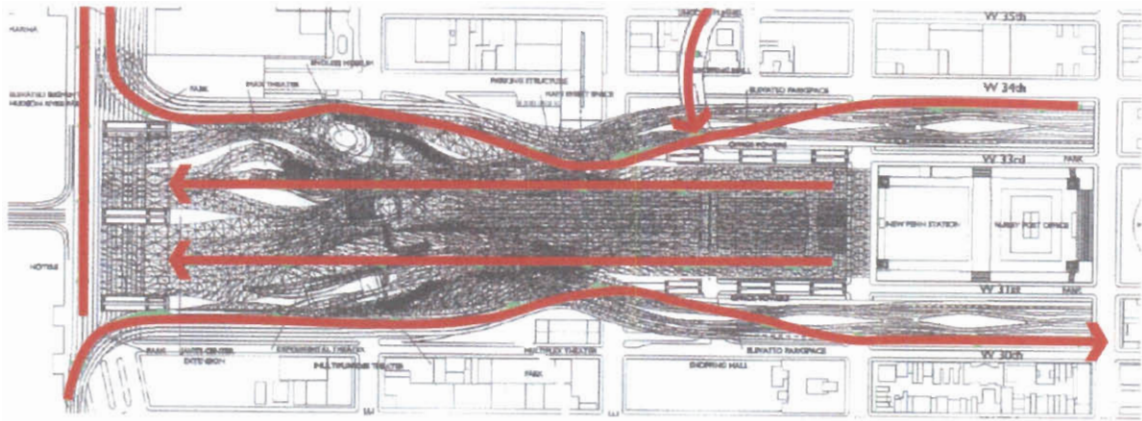
Field of Flow Vectors



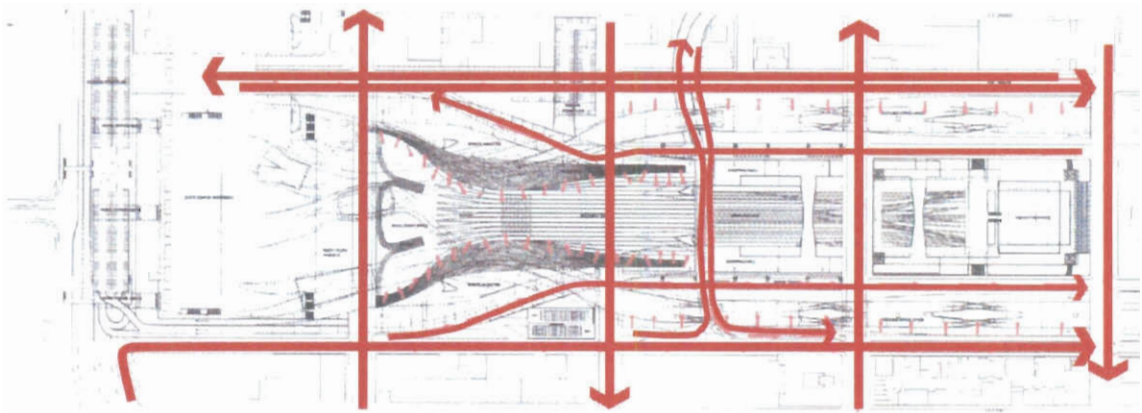
Inhabitable roof under the big roof



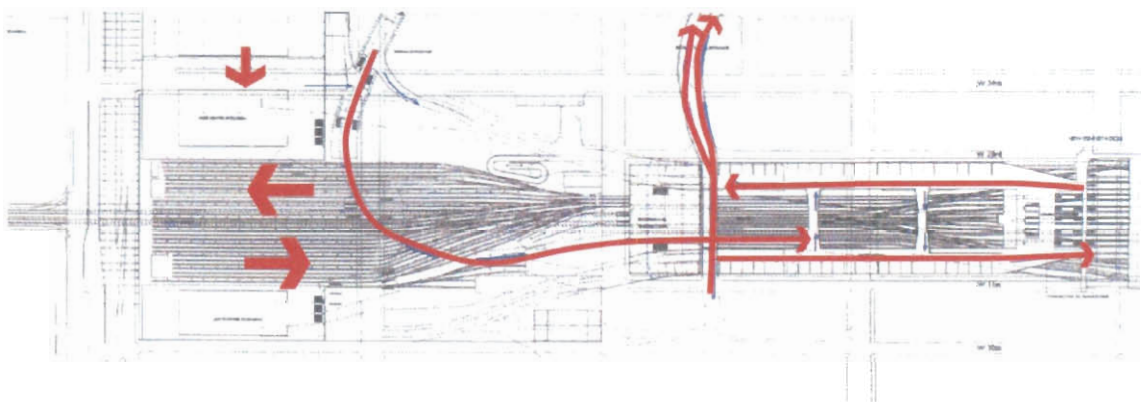
landscape and recreation under the big roof



Global Parkscape



Local City Grid



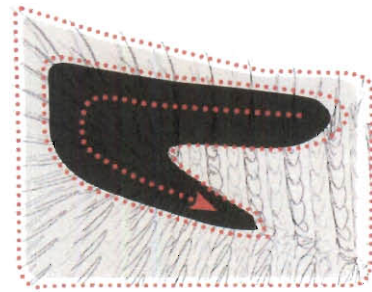
Global Transportation Infrastructure

Vector Field Case Study 2:

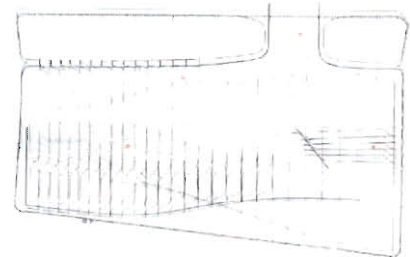
Reebook Shanghai Flag Store, Ali Rahim, Shanghai, China 2004

The building is actualized by generating a dynamic system of vectors, the properties of the vectors refers to the intensities of different activities and their relationships. The vectors interact with each other, generating pressures inside the system, and provide feedback for the formation process, which defines high density areas and low density areas, to divide the building scientifically.

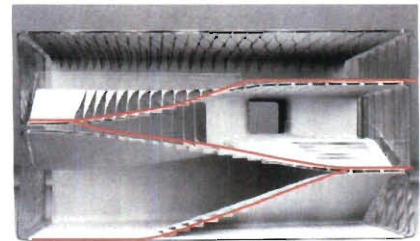
Ali suggests generic architecture generated by parametric skills. He prefer "virtual" rather than "actual", "actualize" rather than "realize". This instance represents many algorithmic or morphogenetic



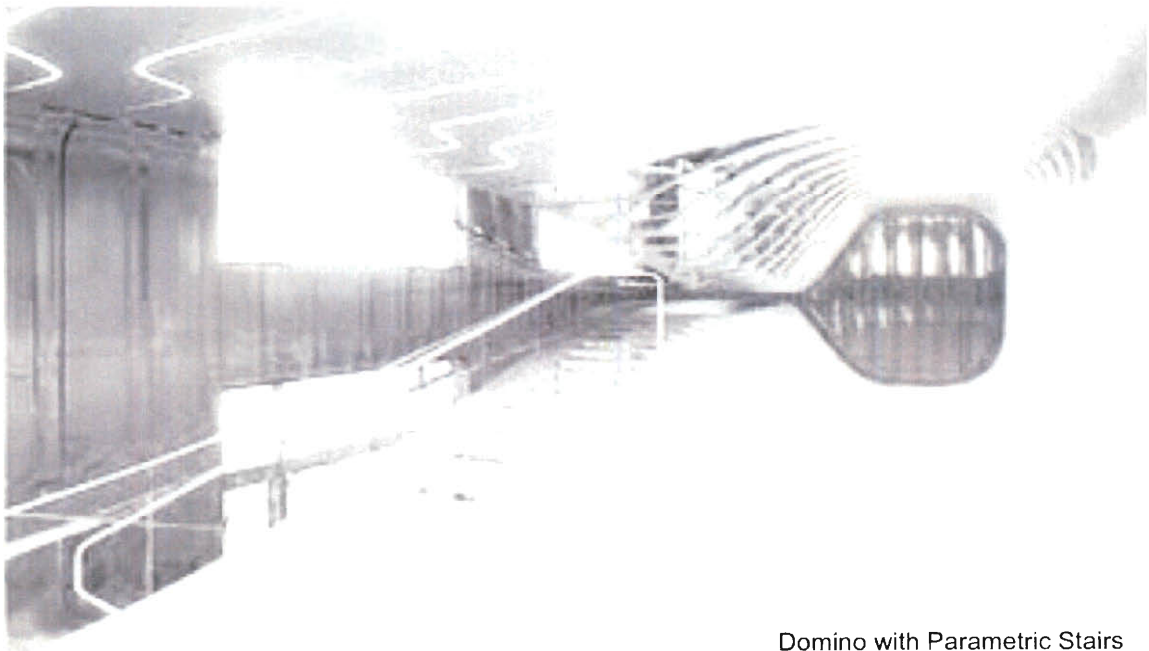
based on the parametric generation, stairs are located in "dynamic" area



Second Floor Plan



Model Section



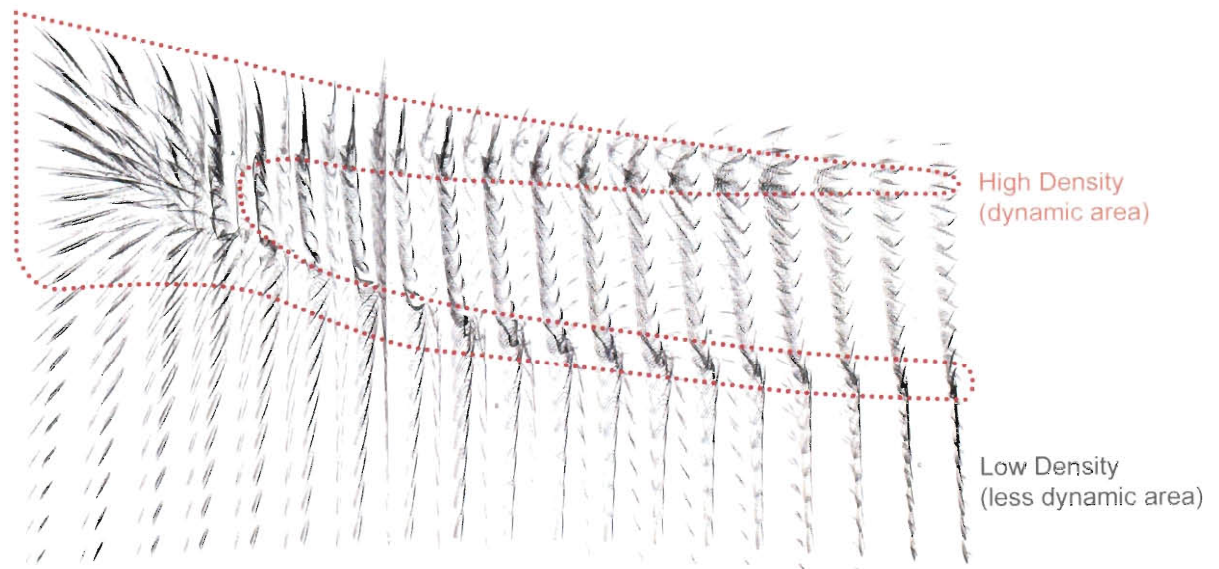
Domino with Parametric Stairs

methodologies, by which the architects argue that this kind of systems are always transforming and adaptive to contingencies, simulating crucial forces and important parts of a project.

It is true that they are super adaptive on computer, and productive for contingencies. However, once the design process is ended and the building is built, the dynamic field will be petrified, it is used in the same way as all other buildings, before the day constructed buildings become transformable.

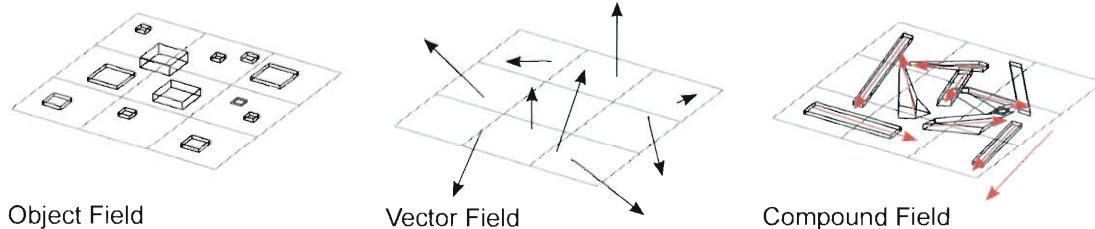
From the 3D model, we can see the metaphysical vectors appeared on the diagrams disappear from the continuous surfaces, in sections, in perspectives. The Reebok store should be a diverse place as Ali planned, but the building has just one continuous space, one material, many shoes hanging on the wall and many people sitting on the stairs. It's a domino with parametric stairs.

In conclusion, though the vectors fields have a higher level of organization, The immaterial forces and parameters need to be bounded back into the material objects. If only translate them into continual surface, the results are not much different from a simple shed or the domino prototype.



Trajectories Formed by Vectors

COMPOUND FIELD



According to the research of previous chapter, both object field and vector field have their certain limits. The Object Field is constituted by volumetric masses and spaces, solids and voids; The Vector Field is composed by vectorial lines, either of physical forces or virtual relationships. While pure object field lacks dynamic connections for its components, pure vector field lacks physical materials to carry these vectors. The former is just the starting point on the journey from object to field, it is more object than field, it is a dispersed version of figure-ground pattern; the latter shows its potential for complicated problems, but is applied in a problematic way, it is too virtual, it is too metaphysical, it needs to be architecturalized.

So, why not combine this two kinds of field? Not to overlay, not to collage, but to interact them as a compound, a compound field, in which the components have both the objectivity of objects and the vectoriality of vectors.

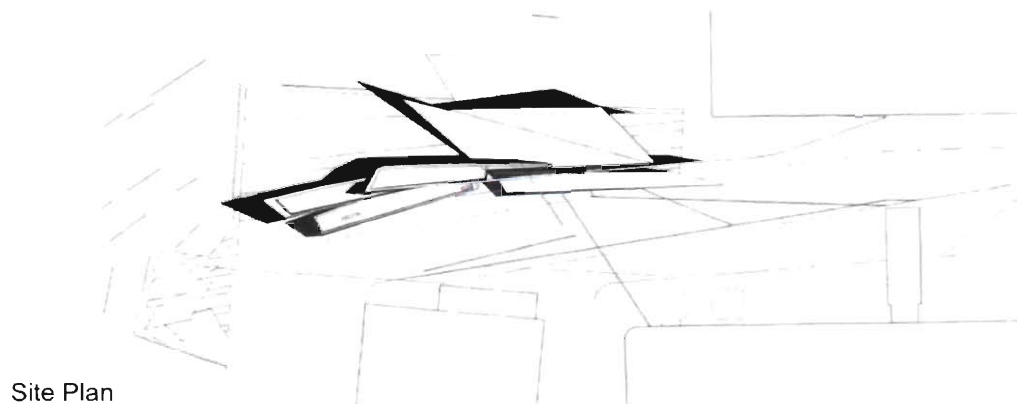
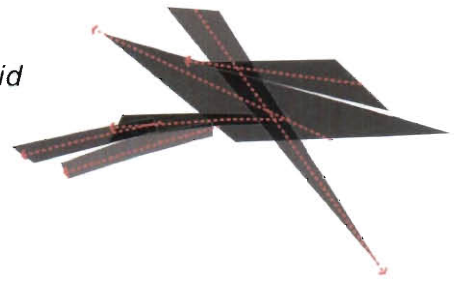
I find some precedents already showed the intention to merge objects and vectors together, though not considered as typical instances for field condition. In this chapter, two such projects will be studied.

Compound Field Inspiration 1:

Vitra Fire Station, Weil am Rhein, Germany, Zaha Hadid

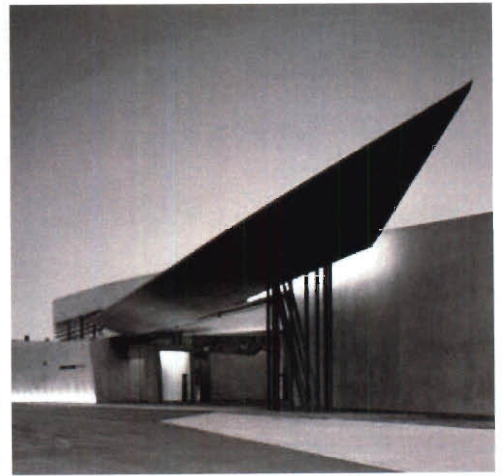
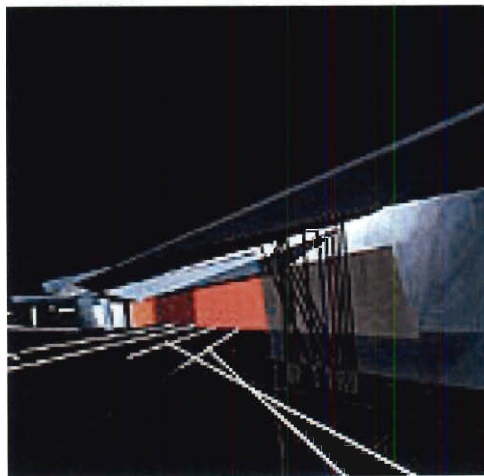
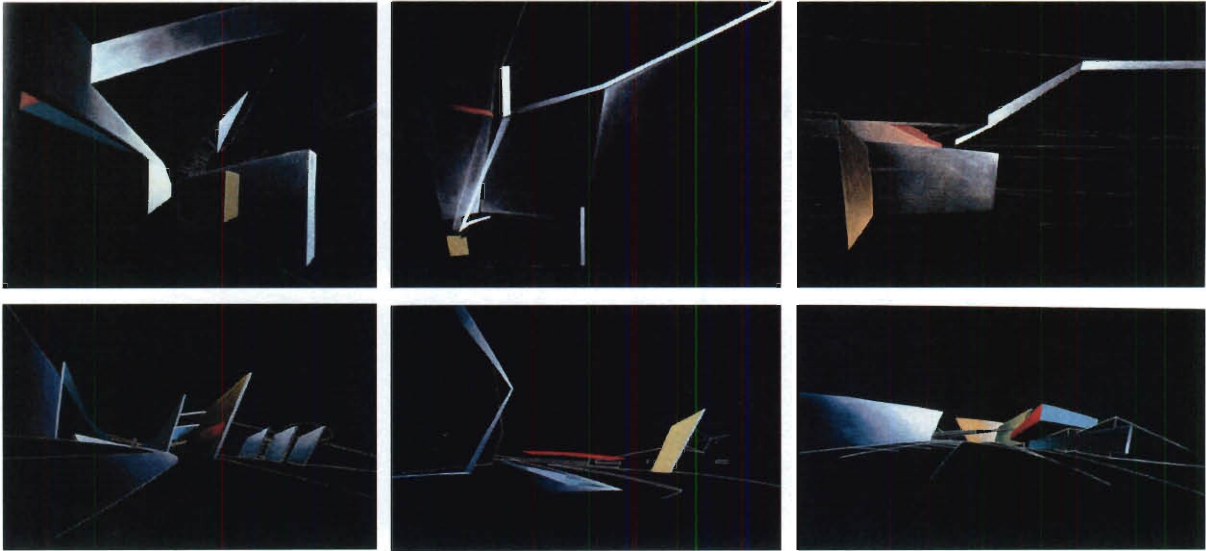
In this project Zaha Hadid uses exaggerated surfaces as primary vectors to organize the whole system. The vectors of the flow inside the building are not just a diagram, but within the physical objects. The flow from inside to outside is dramatized so strongly that the vector field takes effects on a much larger area than its own square footage, and is consistently readable in plans, perspective, and built spaces.

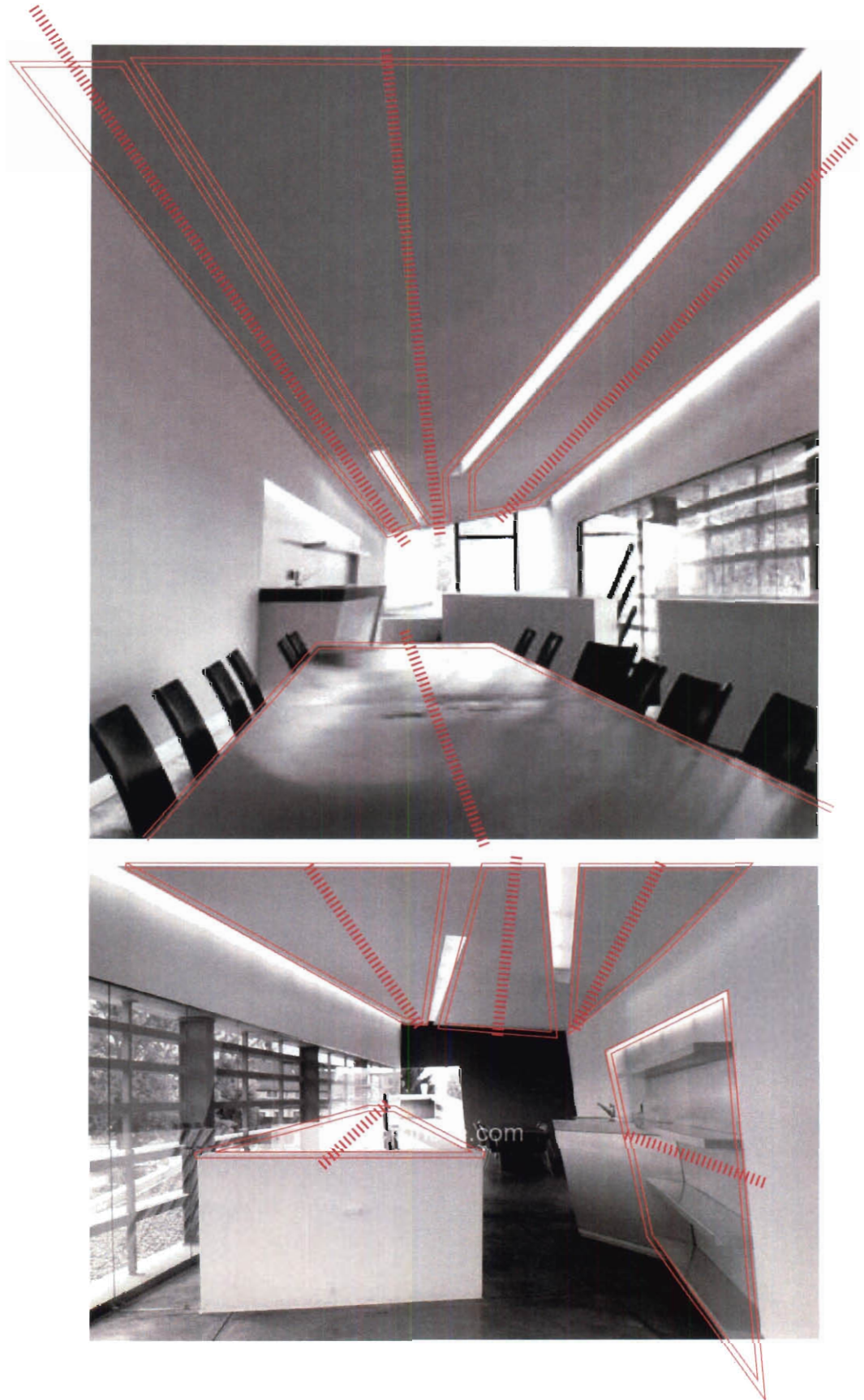
The unique drawing working method makes the vectorized project very consistent from drawing to building. Though the landscape part of the proposal was not built, most vector elements on the drawings were finished, and strongly sensible to human inside or around the building.





Conceptual Rendering (color altered)

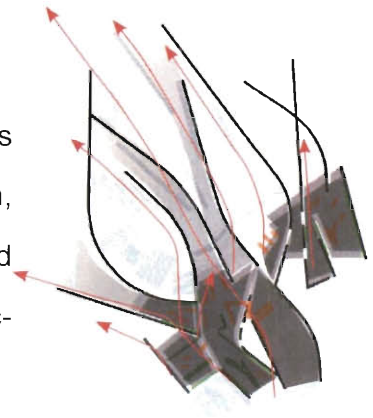




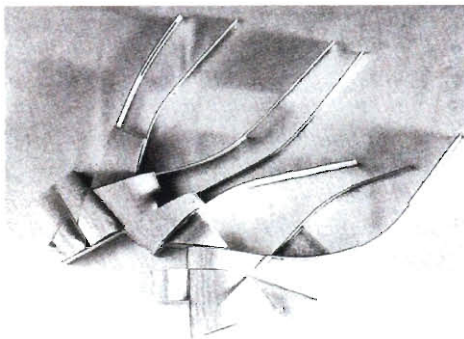
Compound Field Inspiration 2:

Palafolls Public Library, Enric Miralles, Barcelona, Spain

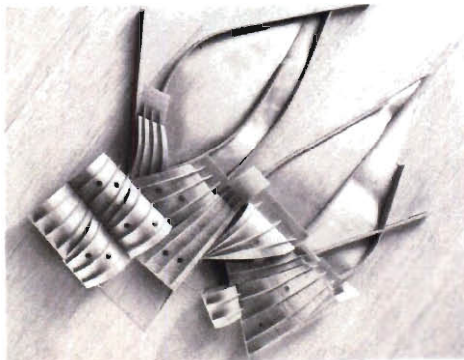
In this project, Miralles used a series of transversal walls as primary vectors, to organize several compound field system, from volumetric spaces to furniture such as book stacks and reading tables, creating extremely diverse vectorized spaces.



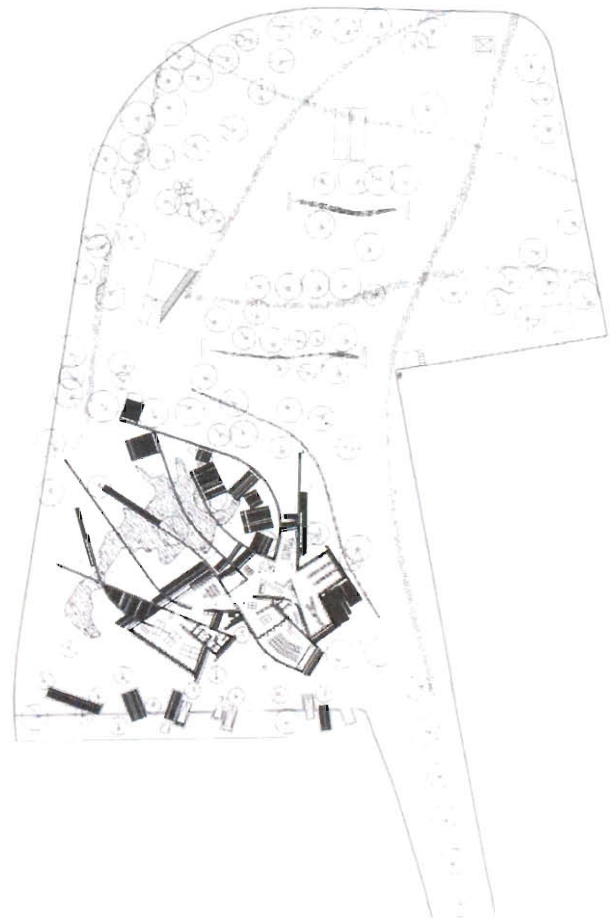
Each of the several volumes is clearly defined as a unity, while the interpenetration of all kinds of spacial vectors, lights, stacks and tables make them a interacting whole. The system does not sacrifice its parts for its whole, while keeping the vector qualities.

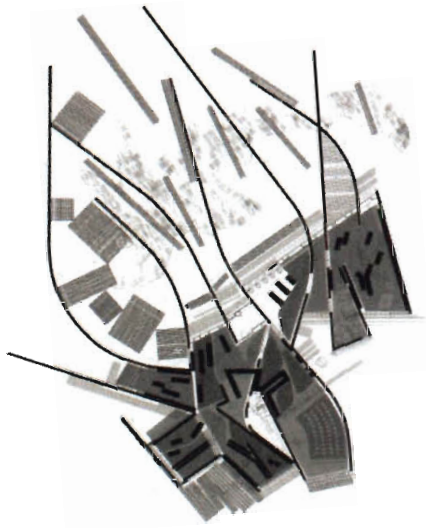


Volume and Landscape



Roof Structure





All Components



Walls



Landscape



Volumes



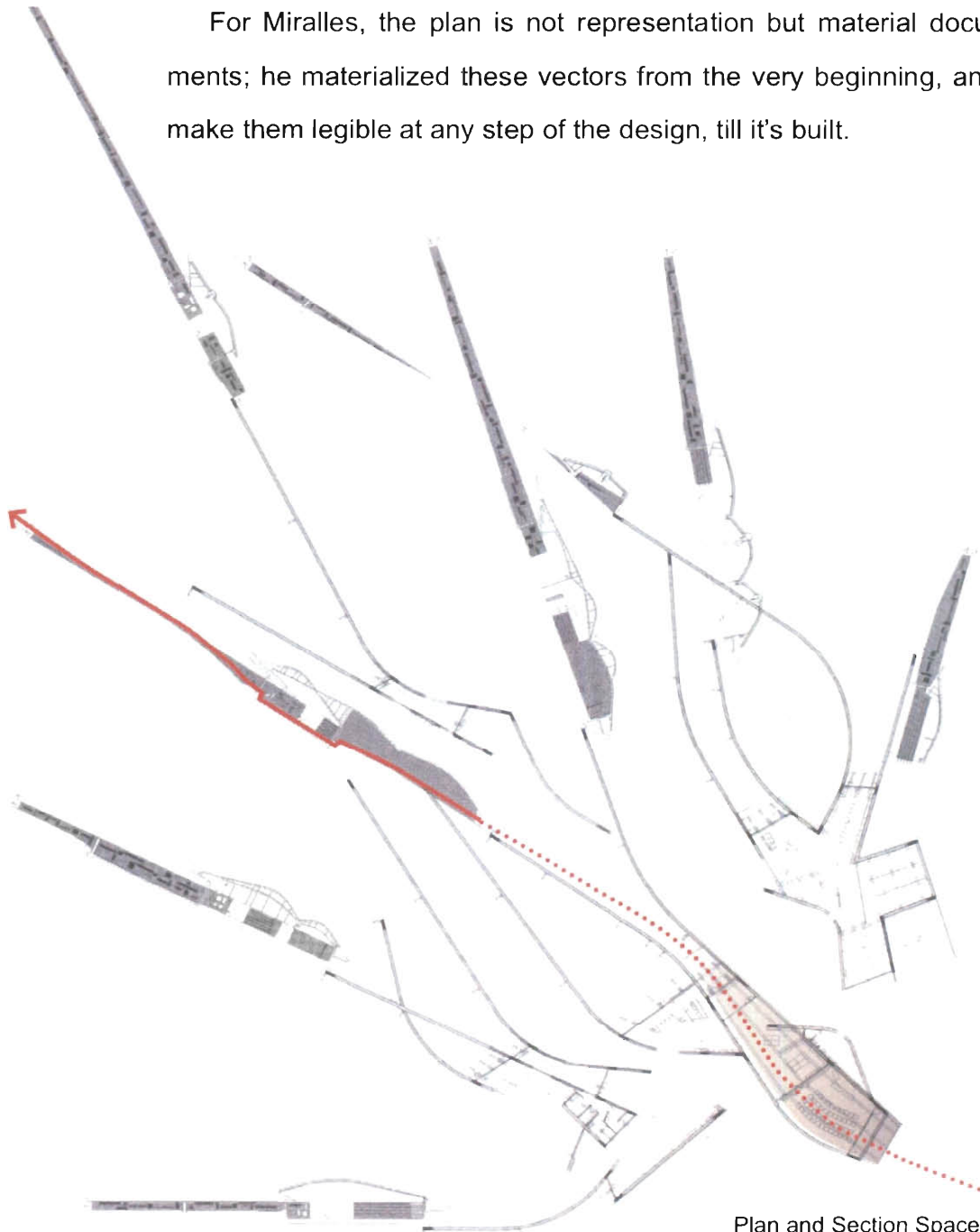
Tables



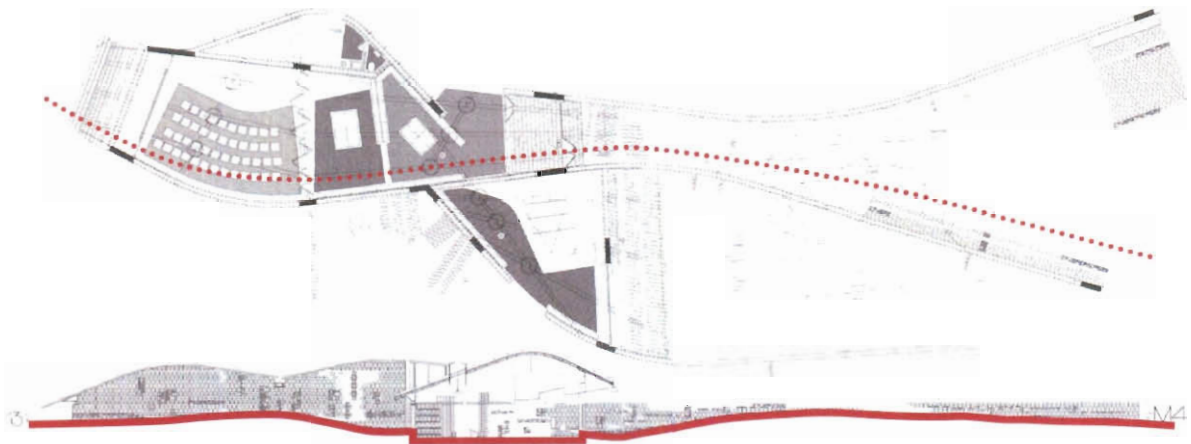
Stacks

The most important vectors in Miralles' works are volumetric spaces, which are defined by walls, roofs, beams and even stacks, flowing out along the transversal walls. In order to emphasize the vector property of the space, all the sections are drawn along their own vector directions on the plan.

For Miralles, the plan is not representation but material documents; he materialized these vectors from the very beginning, and make them legible at any step of the design, till it's built.



Plan and Section Spaces



Partial Plan and Section



vectoriality of space



OBJECTIZE AND VECTORIZE

By analyzing the earlier works of Zaha Hadid and Enric Miralles, or some other similar works, a new field concept as “compound field” is proposed. But if compare the two cases in last chapter there is apparently two kinds of approaches.

For Zaha Hadid, the dramatized surfaces are transformed from the conceptual vectors, which exist in her earlier drawings. It is a way to objectize the vectors into a diverse field system. For Enric Miralles, he considers physical rather than abstracted, he considers all the different architectural components first, and then vectorize them with vectorial properties. These two approaches may seem the same, with the similar results, but they start from two different sides.

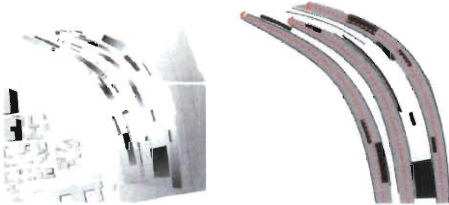
So, looking into objectize and vectorize, and differentiate them, is helpful for widening the thesis, and can help me to decide which approach to use for specific problems.

Vectorized Objects

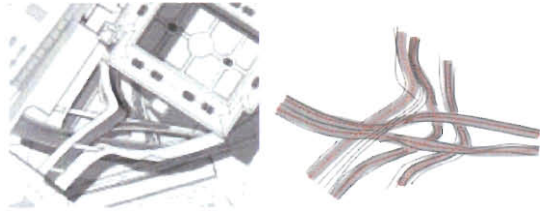
Objects are vectorized through geometric variation, transformation and exaggeration.

In Zaha Hadid's project, the objects are operated in a vector way, to create connections and interactions.

linearize



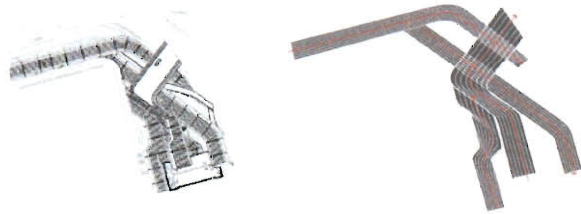
interweave



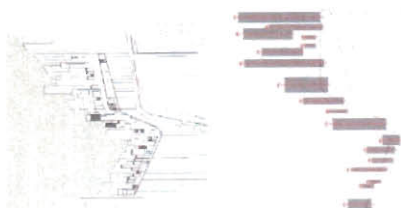
polarize



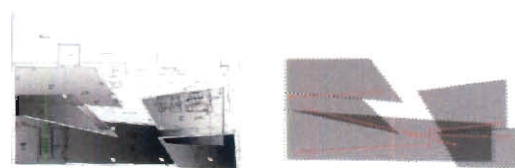
intersect



undulate



interlock



Objectized Vectors

Vectors are carried by specific objects, with a wide range of scale

Miralles' design process is a never-ending conversation rather than inventing first and materializing afterwards. he argues that diagrams have no abstract value, only by material quality can the abstract value be created.

Volume (mass, space...)



components (beams, mullions, panels...)



divisions (walls...)



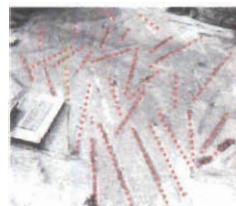
furniture (seats, tables, stacks...)



surfaces (roofs, ceilings, floors...)



texture (holes, patterns, collages...)



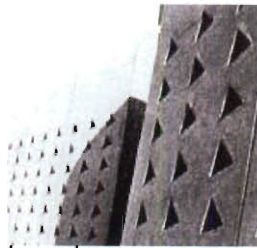
As two major methods of compound field, vectorization and materialization can be used together for complicated systems. While the former can weaken the objectivity and interact different parts as a whole, the latter can endow the vectors with architectural meanings and physical qualities.

Spectrum of Compound Field

When the proportion varies, compound vectors functions differently, and its two extremes, extremely vectorial and extremely objective are both limited. Only the vectors and objects within certain scale are both sensible and effective.

To continue the research of the proposed compound field, a site should be studied to provide enough vectorial resources, since objects are comparatively easy to find in an architectural system.

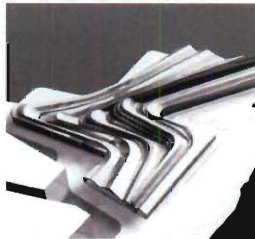
proportion of vectors compared with the whole system



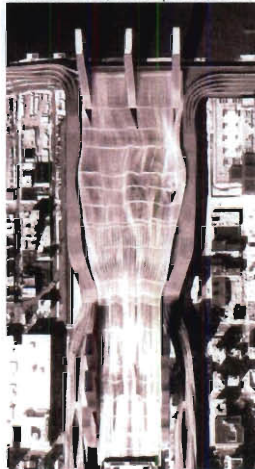
Internal vectors:
walls, in habitable roofs, stairs, ramps, benches, railings, beams,



Local vectors:
driveways, views, contexts, landscape surfaces, roofs, walls, visual connections



Global vectors:
infrastructures, freeway, river, or train tracks



sensibility
objectivity
vectoriality

SITE AND VECTORS



The waterfront of Seattle is a diverse and complex urban area. The steep ramp toward Elliot Bay and dense railway trails once totally blocked downtown from the waterfront; later, most of the railways were discarded and Alaskan Way was developed into a busy commercial tourism street, however, the freeway carried by the Alaskan Way viaduct became another obstacle. Recently, the city of Seattle decided to remove this viaduct. With the removal of the viaduct, a lot of new forces and potentials will be released, adding onto the existing ones. This is just the good site I need to test the compound field.

Historical Changes



1900, Railroad Avenue (Now Alaskan Way)



1920



1910, Railroad Avenue (Now Alaskan Way)



1934



2010, Alaskan Way Viaduct



2010



After the Removal of Viaduct









future



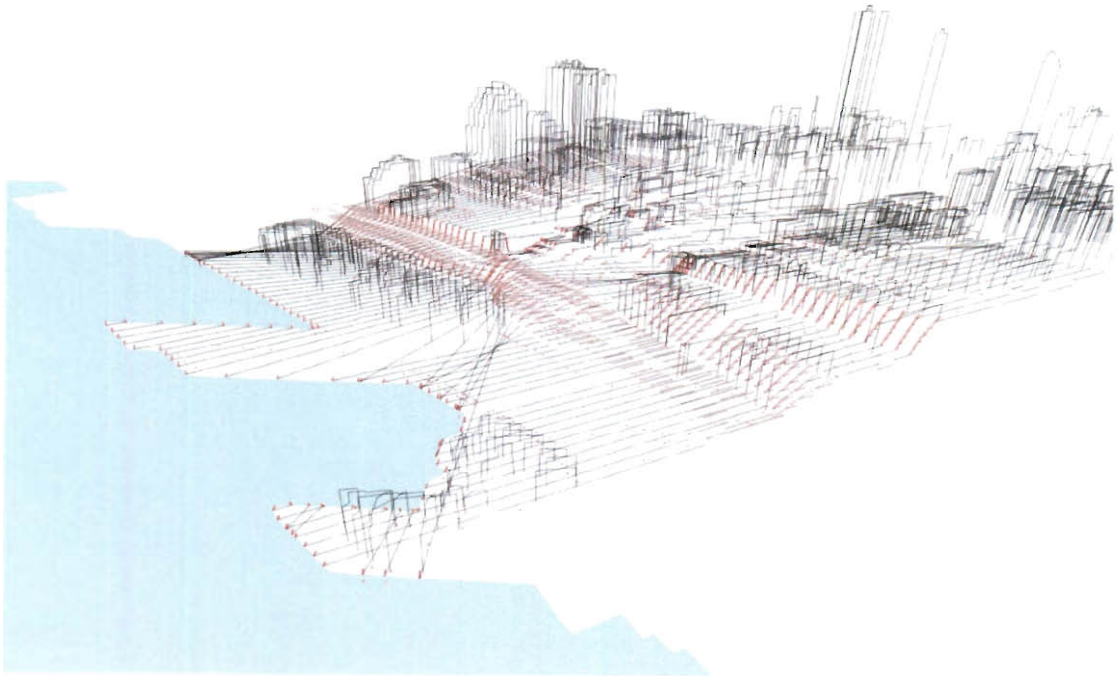
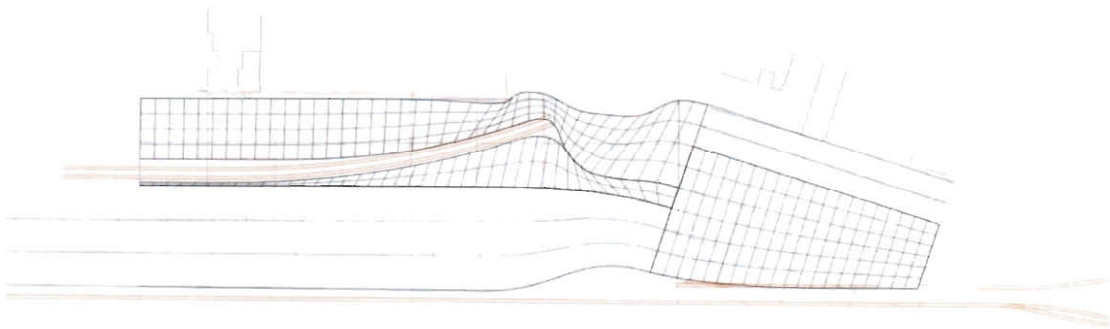
Site Map

Legend

-  Alaskan Way Viaduct
-  Major Streets (Vehicular Connection)
-  Cut Off Streets
-  Stair Connections
-  Ferry & Cruiser Routes
-  Site Boundary

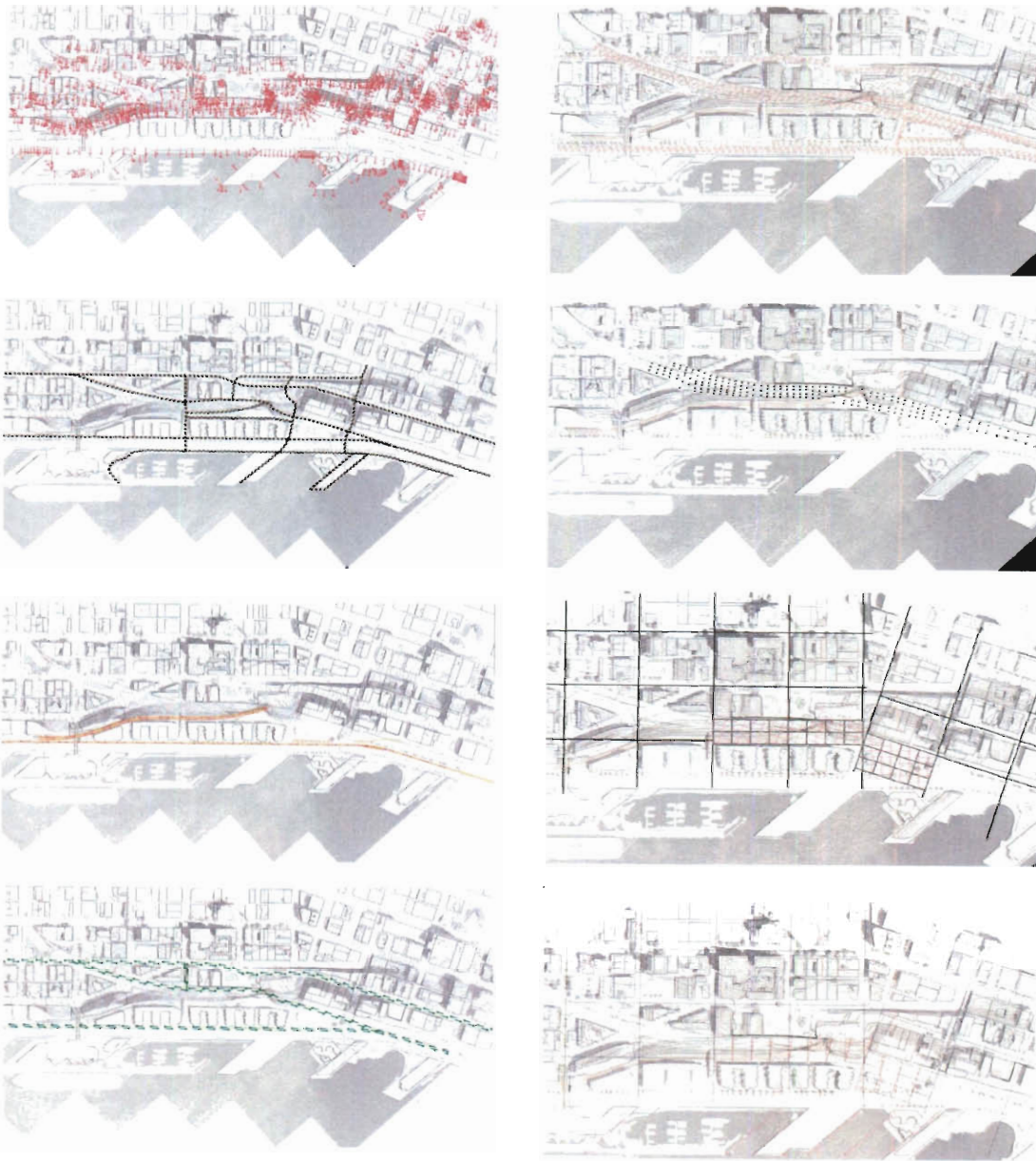
The Impact of Contextual Grids

The site is located in between the famous Pike Place Market and the void Pier 62/63. Three different grids intersect here, one for downtown, one for belt town, and one for the piers by the Elliot Bay. These three grids make this site a focal point in this area.



Vector Analysis

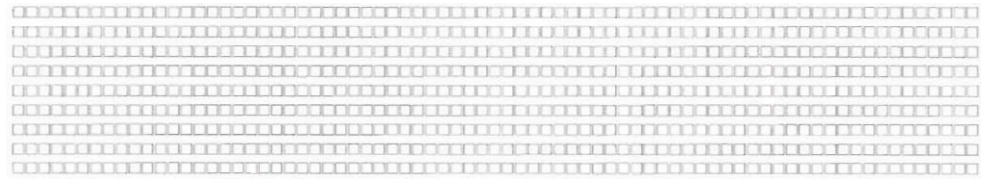
There are existing vectors, which are mainly created by different transportation solutions, and hidden vectors, which are mainly stimulated by the urban context, both of which are useful resources for the research of the site vectors. In the analysis process, Grasshopper and scripting are used to articulate the vectors.



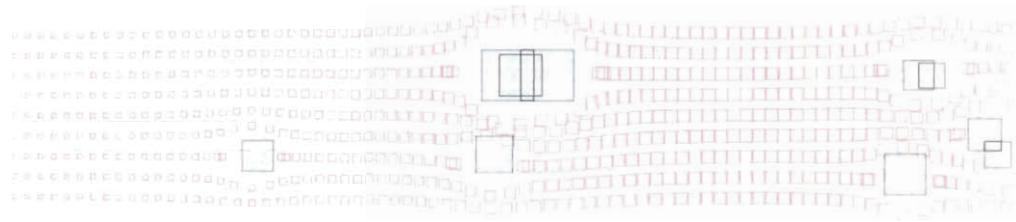
INTERACTION

The crucial process of the development of compound field is the interaction between objects and vectors. According to previous case study, there are two kinds of methods, vectorization of objects and objectization of vectors. In a compound field, these two actions should be coexisting as counterparts, forming a dynamic equilibrium. The process can be started from either objects or vectors. In this chapter, four specific operations are tested to simulate the process of vectorization and objectization.

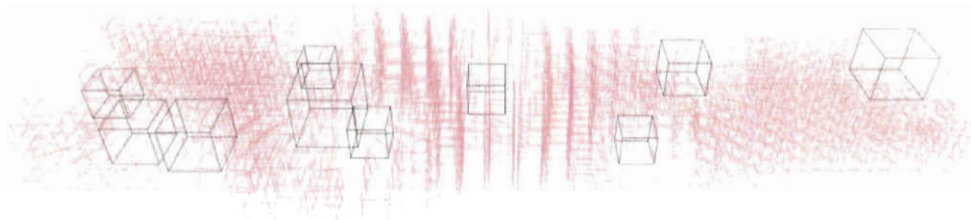
These four operations are actually all based on objects, and the objects are all transformed into compound hybrid (or more accurately, experimental compound hybrid) after the procedures, but there are clear differences. In the first two tests, “Scale” and “Taper”, the objects are transformed by vectors outside of them following certain rules; in the latter two tests, “Distortion” and “Rotation”, objects are not just transformed by the vectors, but also by each other. In another word, for the first two tests, the transformation of objects are passive, and the changing forces are from vectors outside of them; while in the latter two tests, the objects transform each other in a positive way, the changing forces are from the objects themselves, and the objects provide the forces as objectized vector. Therefore, two different kinds of operation methods can be concluded from these tests, vectorization starts from objects, and objectization starts from vectors, both of which can lead me to the proposed compound field.



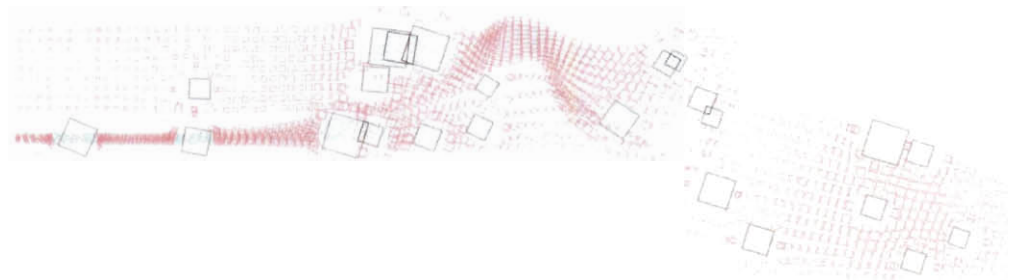
Initial Generic Grid



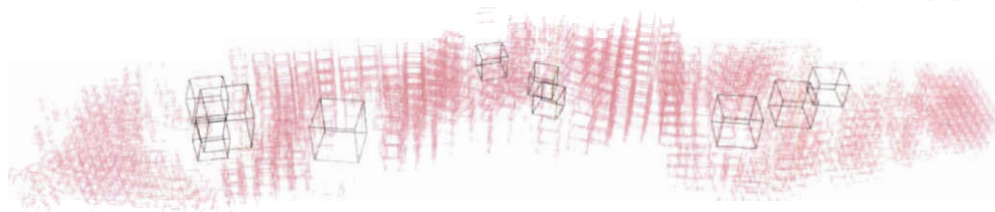
Effect on Generic Grid



Extend to 3D

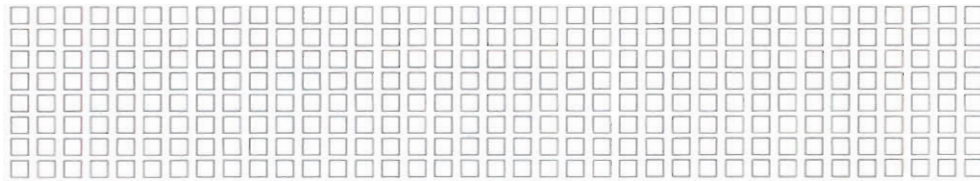


Effect on Site Grid

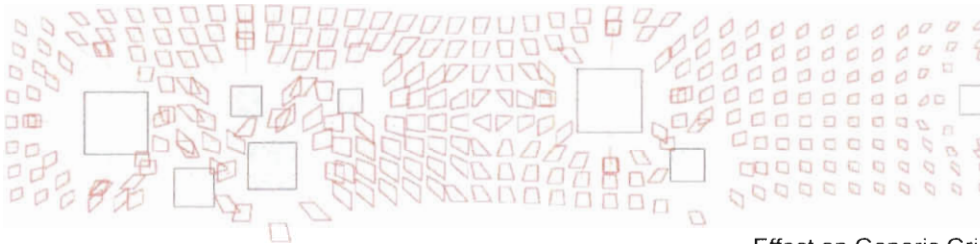


Extend to 3D

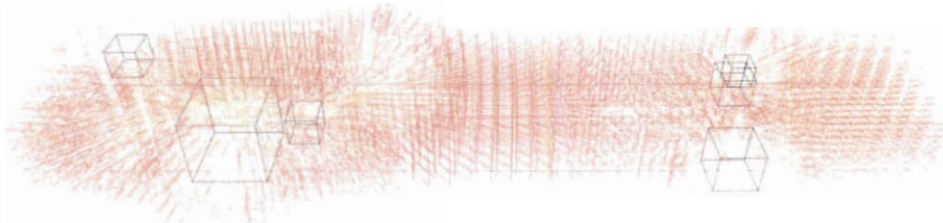
Taper



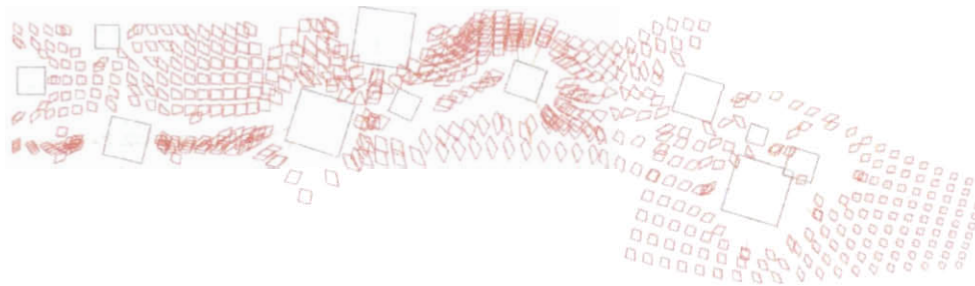
Initial Generic Grid



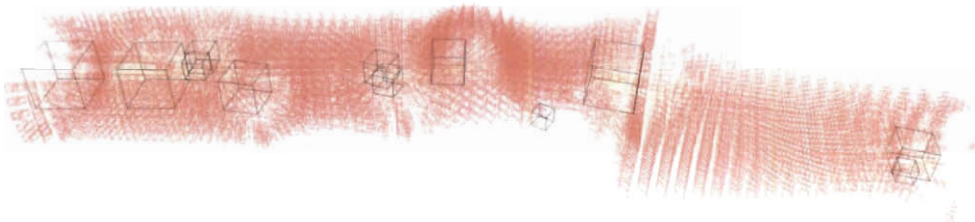
Effect on Generic Grid



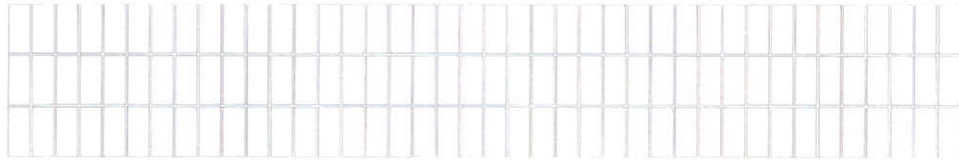
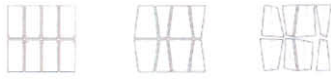
Extend to 3D



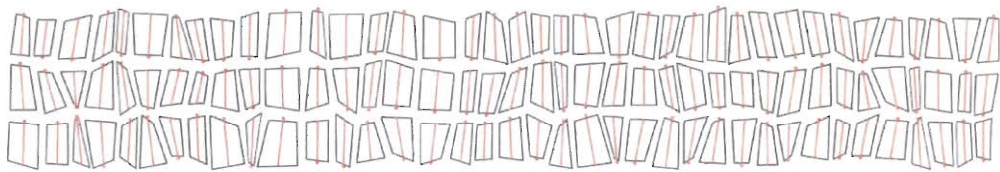
Effect on Site Grid



Extend to 3D

Distortion

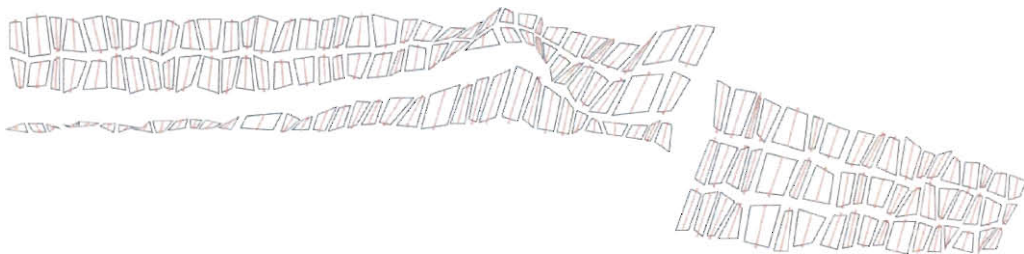
Starting Generic Grid



Effect on Generic Grid



Extend to 3D



Effect on Site Grid



Extend to 3D

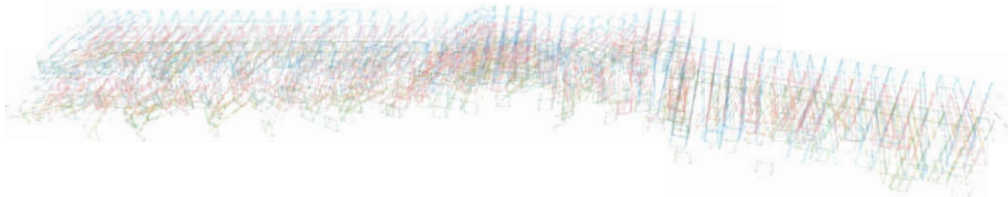
Rotation



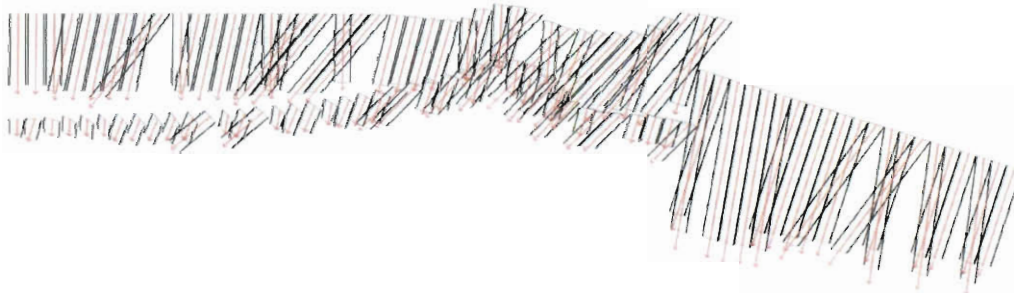
Initial Generic Grid



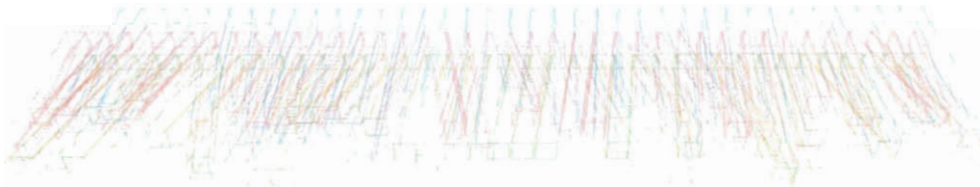
Effect on Generic Grid



Extend to 3D

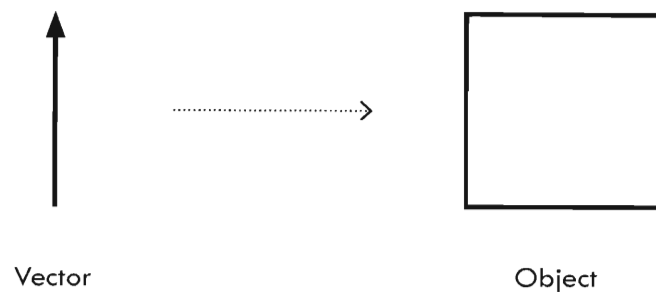


Effect on Generic Grid



Extend to 3D

OBJECTIZE



Compound field, as a design methodology, is a large topic for thinking, but difficult to control as a project. Moving from theoretic research to design process, the operation approach is narrowed down. While objectization and vectorization are both typical operations leading to a compound field, only objectization will be used and developed for the project, in order to deal with the rich vectors generated from the site.

There are three major steps in this process: thickening, faceting, and profiling. The interfered vectors in the urban grid are first thickened with width, and then faceted to articulate the vectorial feeling in space, and at last, they are profiled with sectional modifications, creating diverse connections and vectorial senses in both plan and section.

Three Steps

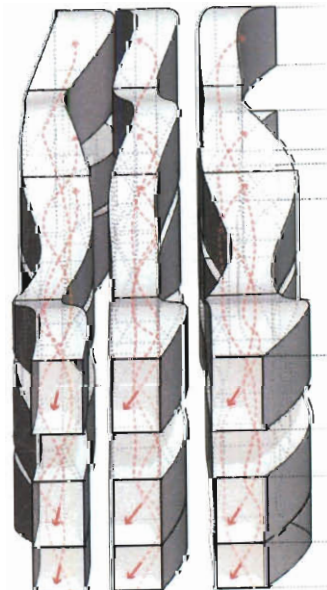
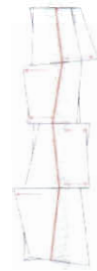
Thicken



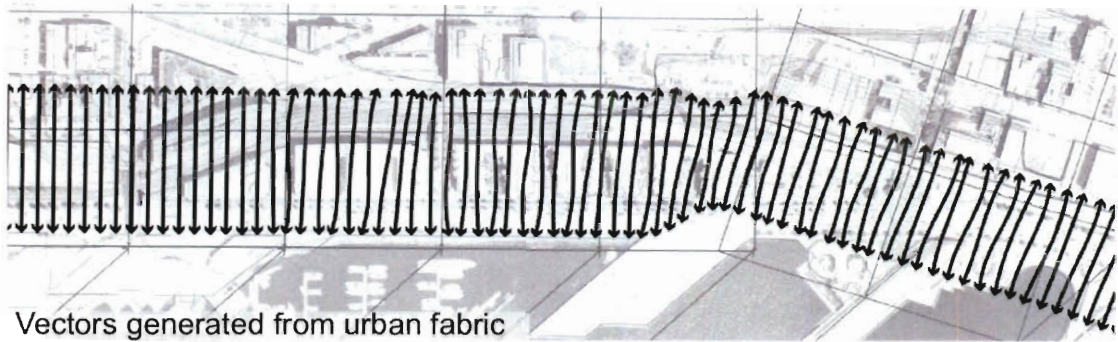
Facet



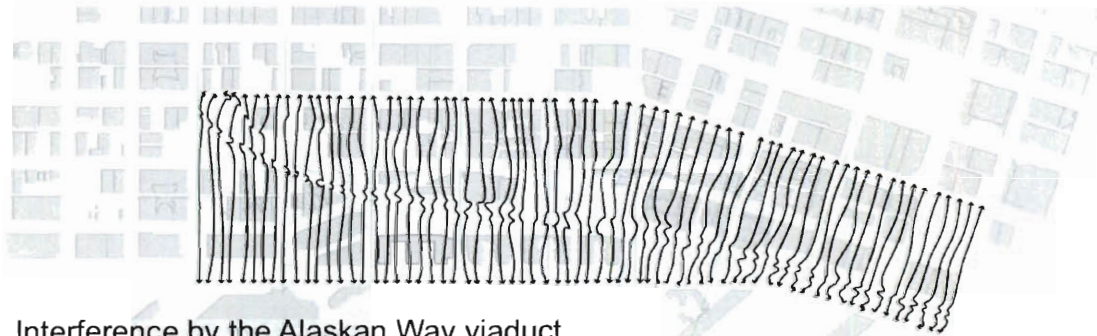
Profile



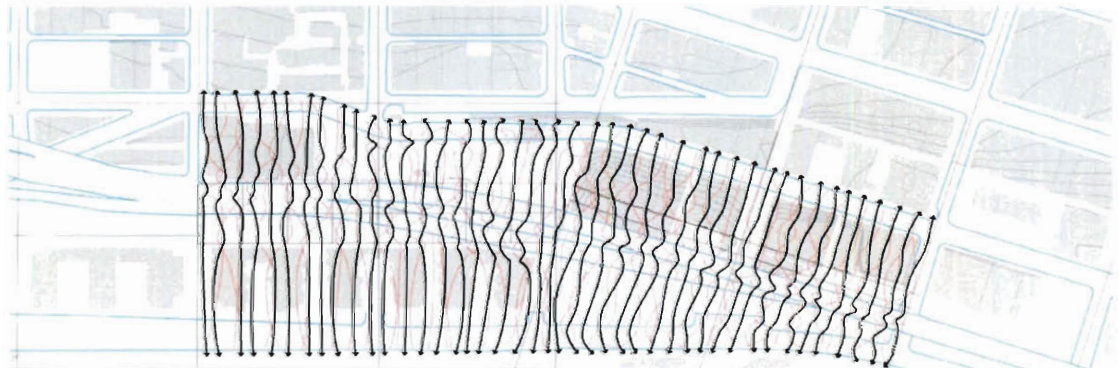
Thicken



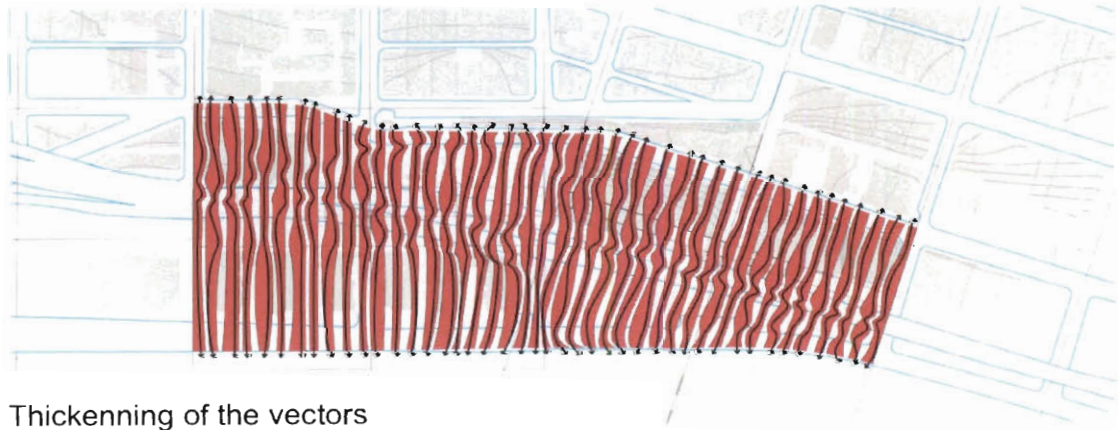
Vectors generated from urban fabric



Interference by the Alaskan Way viaduct



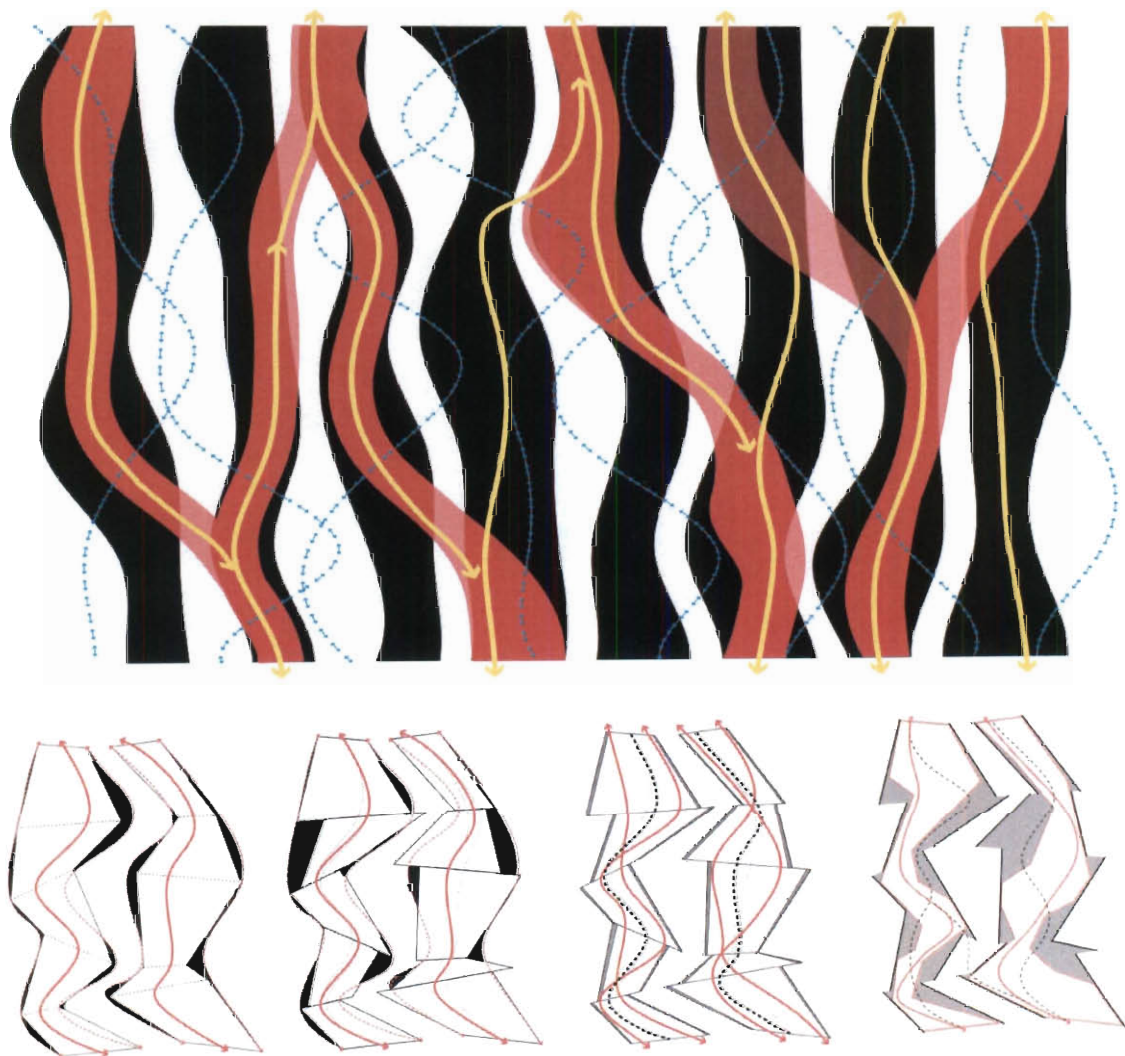
Interference by the removal of viaduct



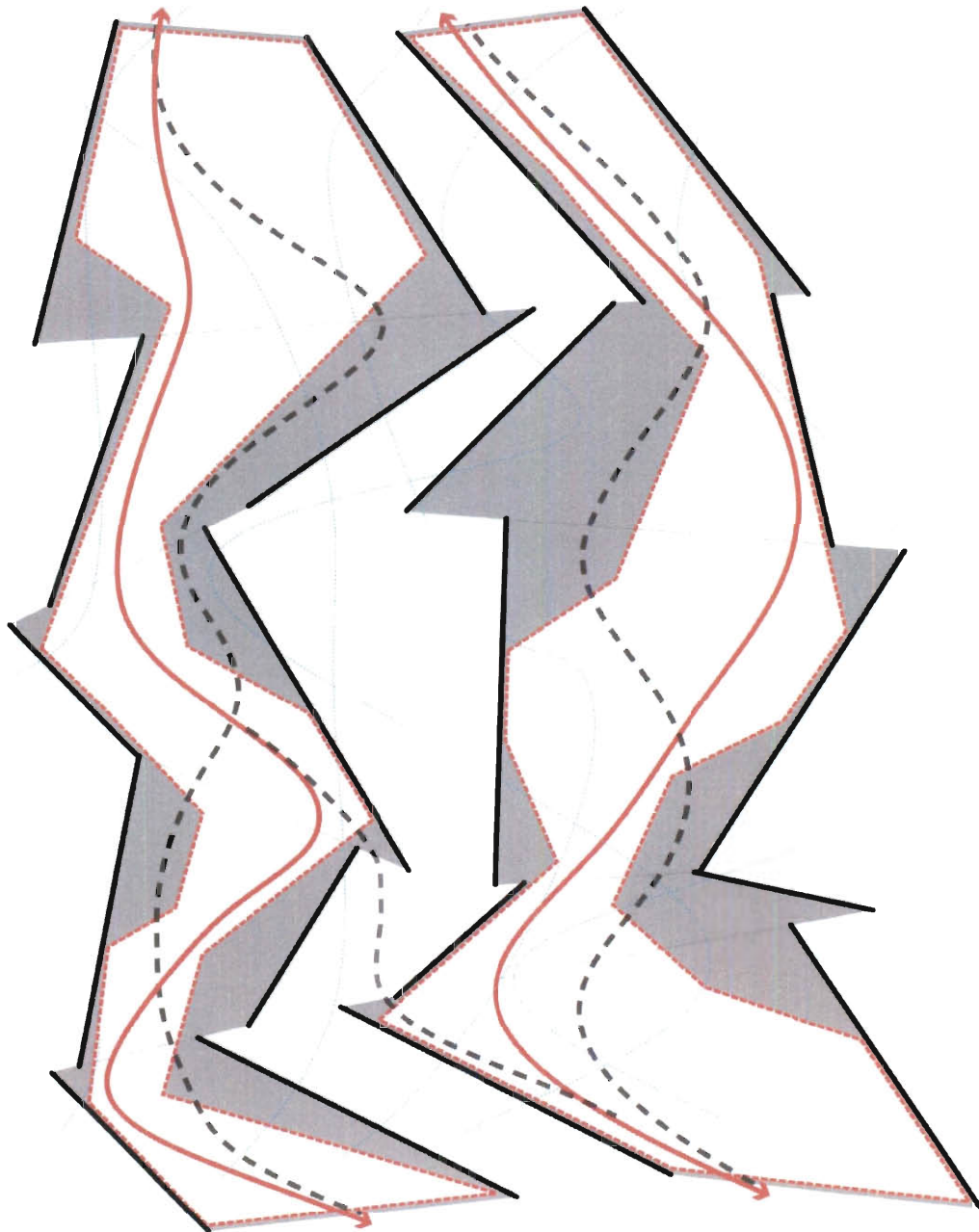
Thickenning of the vectors

Facet

Facet is a very important step in this series. This is meant to develop an operation that is different from the popular continuous surface, when dealing with vectors or vectorial field. As it is criticized in the case study, the continuous surface, though controlled by large amount of vectors, is weak in people's perception of vectors. The metaphysical vectors just exist in the diagrams and the processing drawings are absent in the actual physical space. Therefore, to facet the thickened vectors is a way to trace the vectors at different points. It not just actualizes the virtual, but also make the physical retrievable to its virtual shaping force.

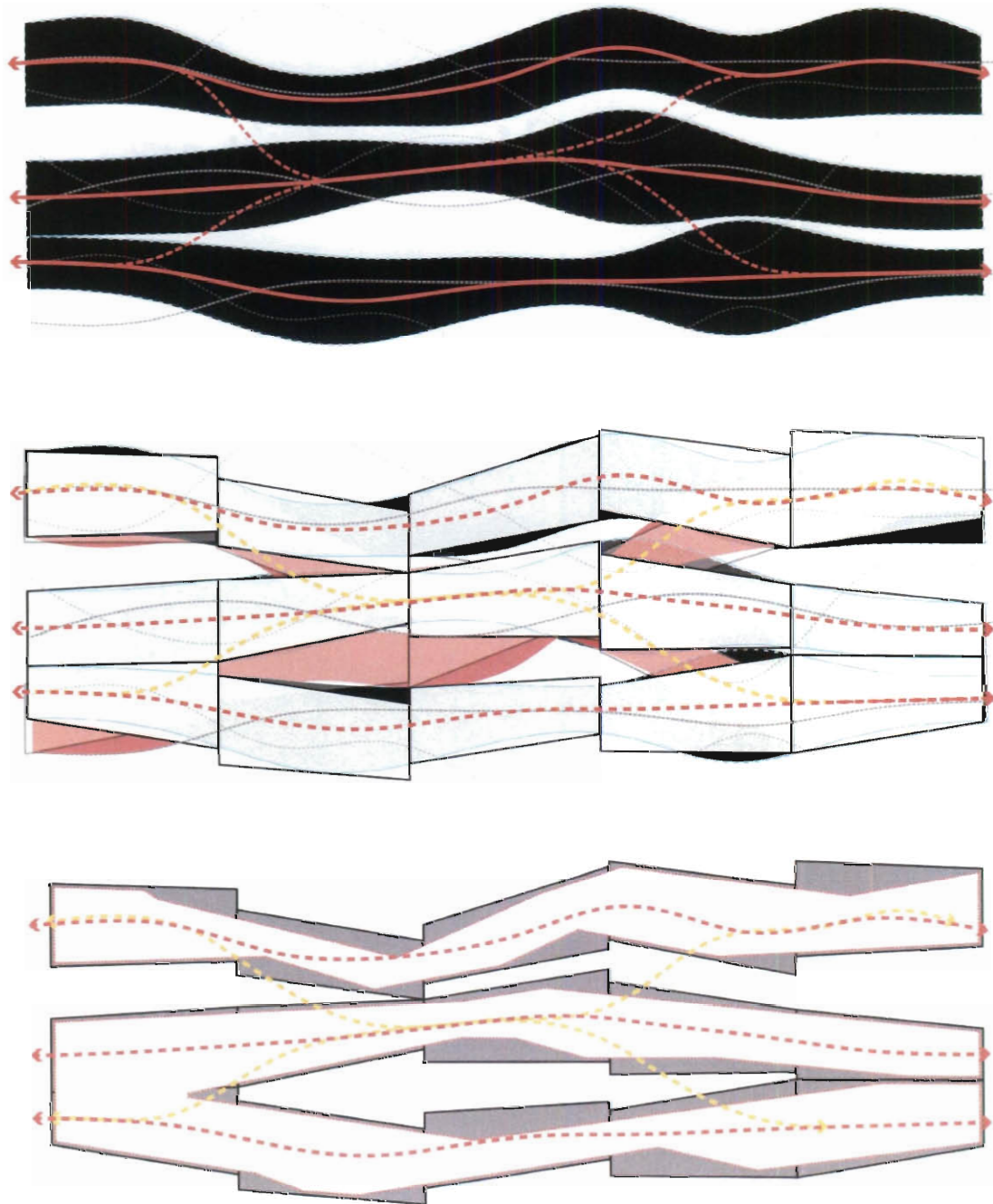


After the faceting, the space can be divided following the shaping vectors. However, the division is independent from the faceting. The turning of the division lines are staggered with the faceted corners.

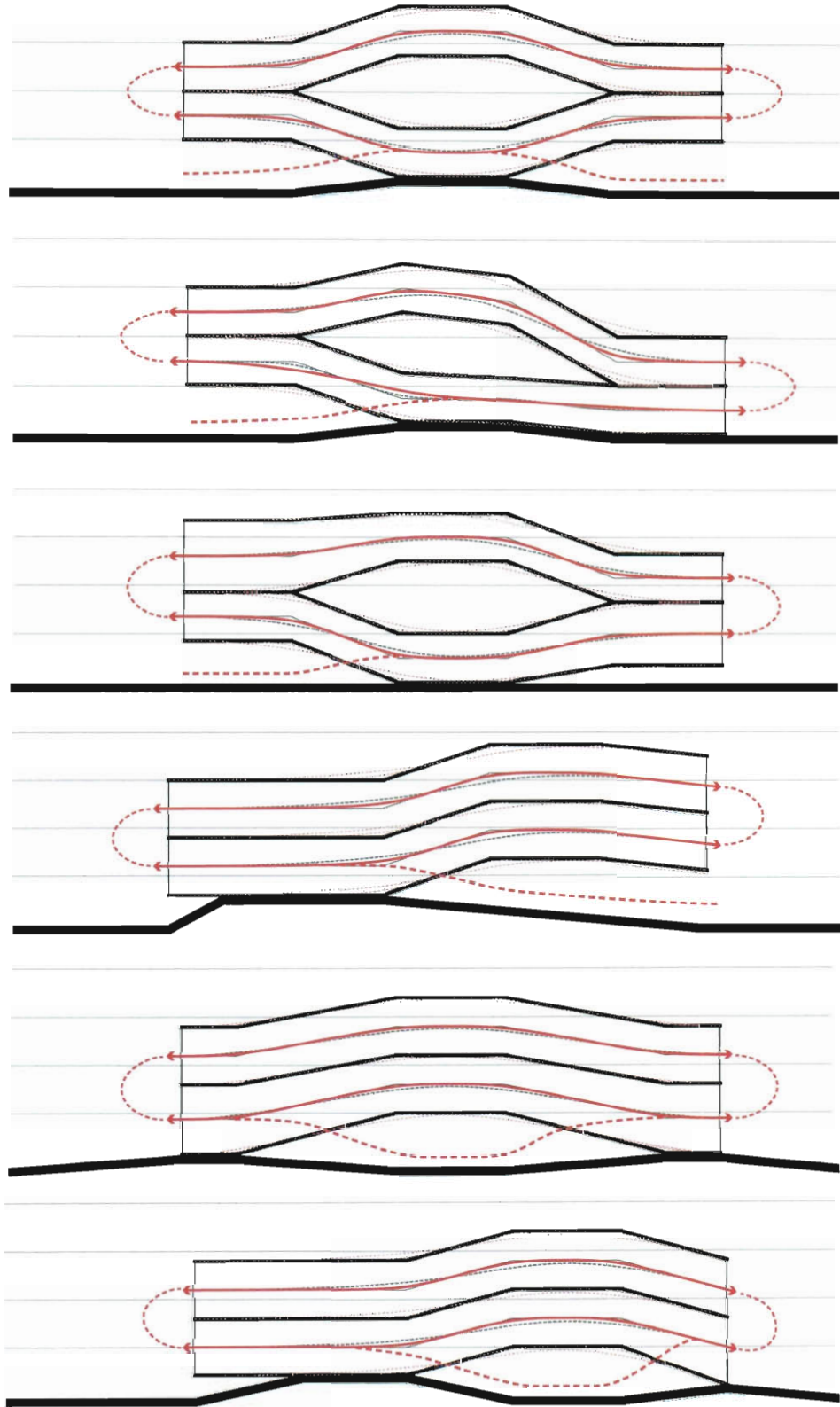


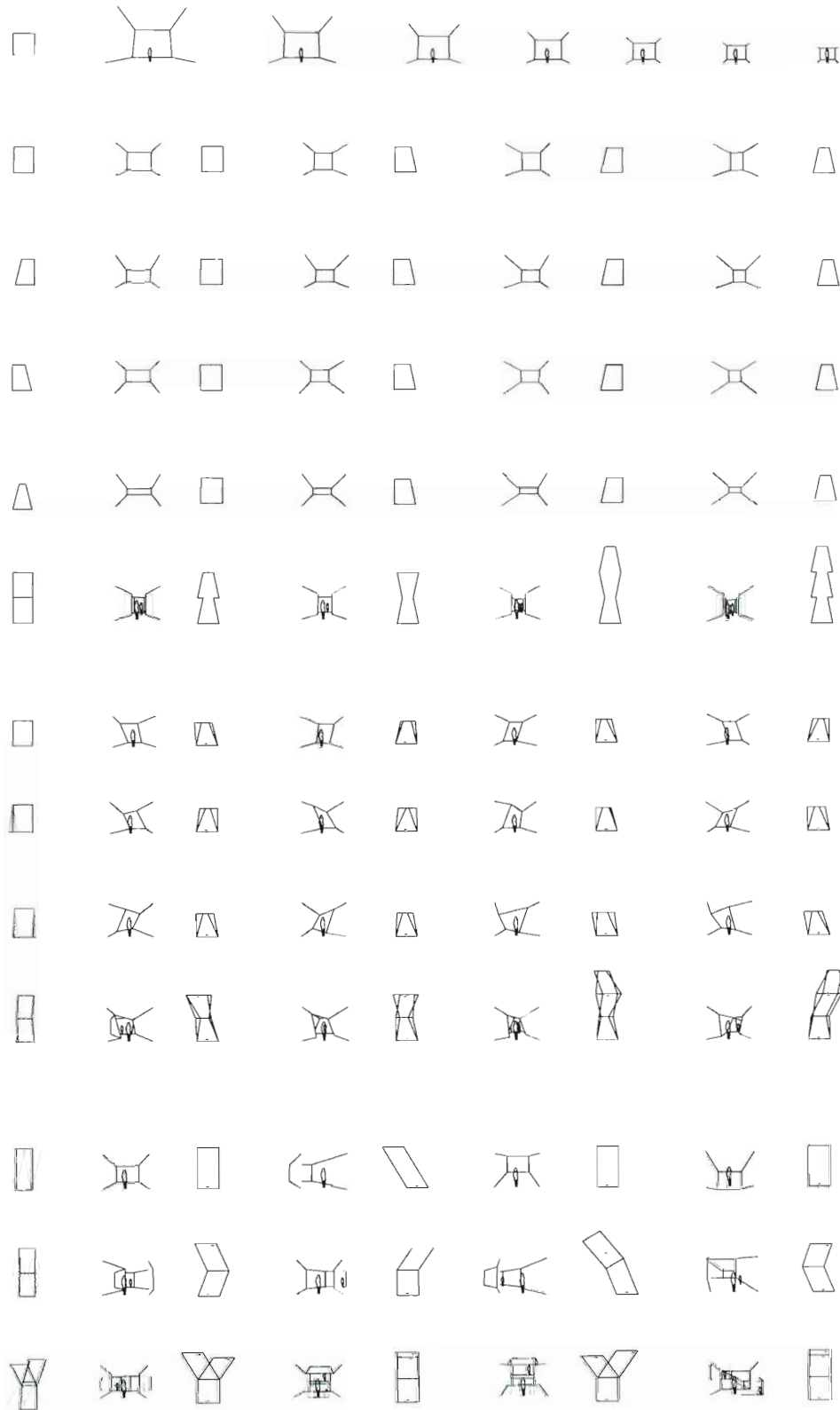
Profile

When profiling the thickened and faceted vectors, operations similar to facet can be used to provide sharp corners and vectorial senses for the vertical spaces. The vertical divisions of spaces can provide spaces for equipment and services.



Profile Potentials





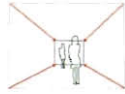
Sensible Vectors in Space

Vectorial Sensations

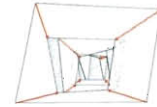
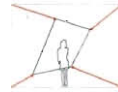
When profiling the thickened and faceted vectors, operations similar to facet can be used to provide sharp corners and vectorial senses for the vertical spaces. The vertical divisions of spaces can provide spaces for equipment and services.



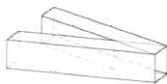
Linearization
by Abstracted Vectors



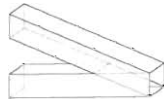
Transformation
by Materialized Vectors



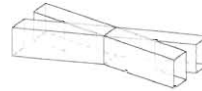
Mutual Interaction



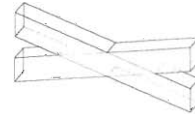
planar merge



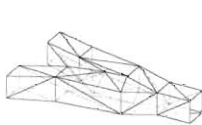
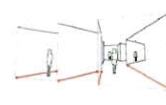
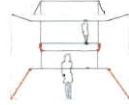
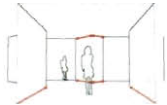
sectional merge



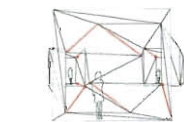
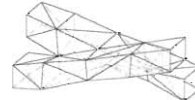
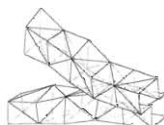
planar cross



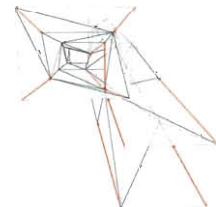
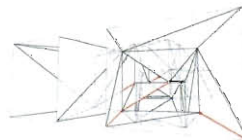
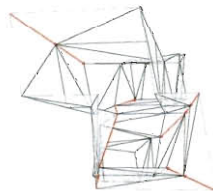
sectional cross



vectorial transform



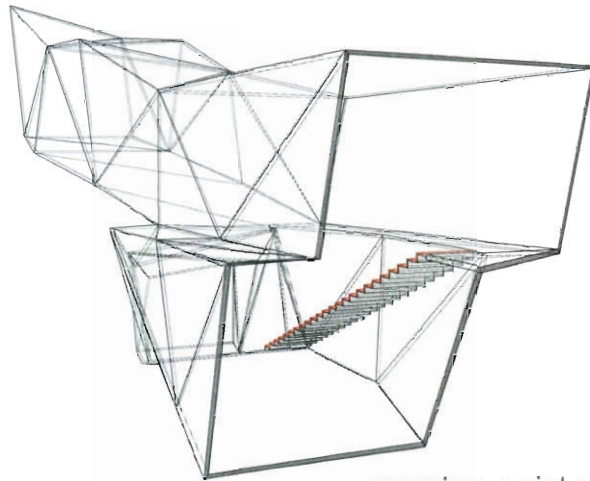
vectorial sense



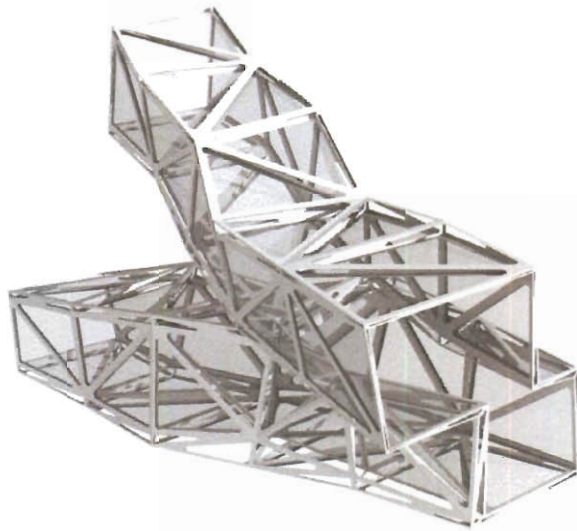
Technical Programs

These “programs” are different from functional programs, they are pre-written in the typological strands as possible choices for design development of next step.

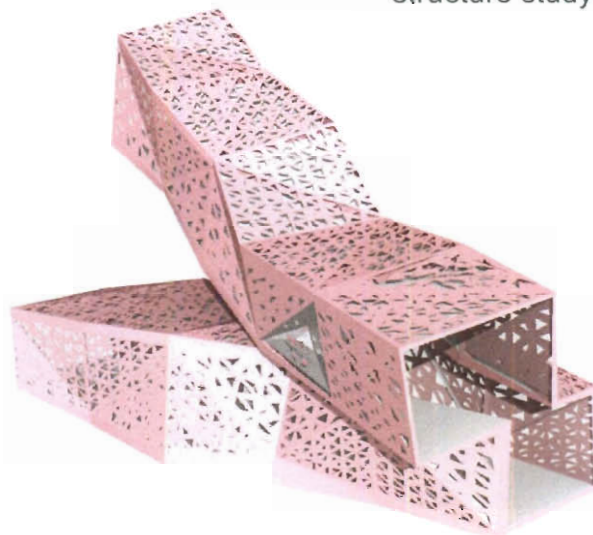
The circulation prototype, the structure system, and the skin tectonics and patterns, will be applied in every similar joint of the building.



merging point circulation

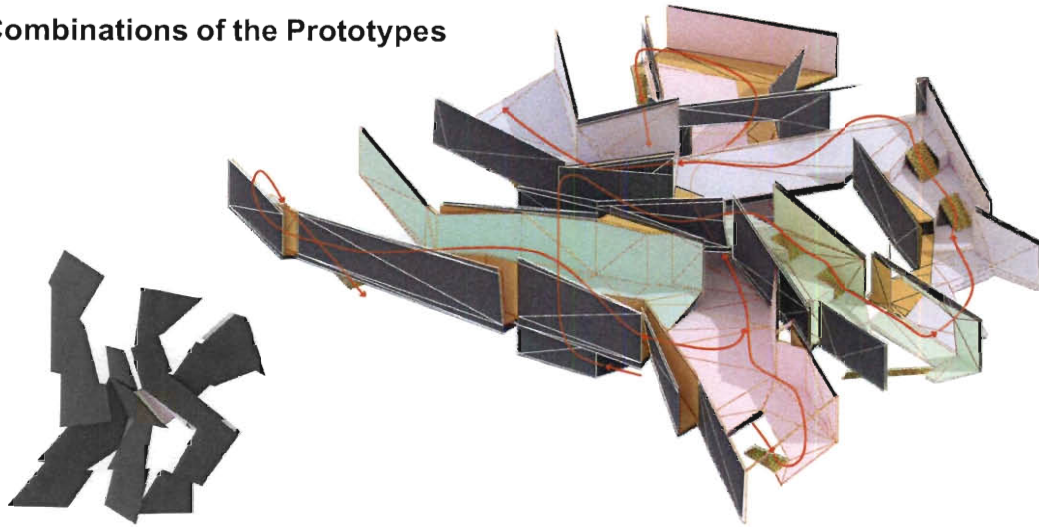


structure study

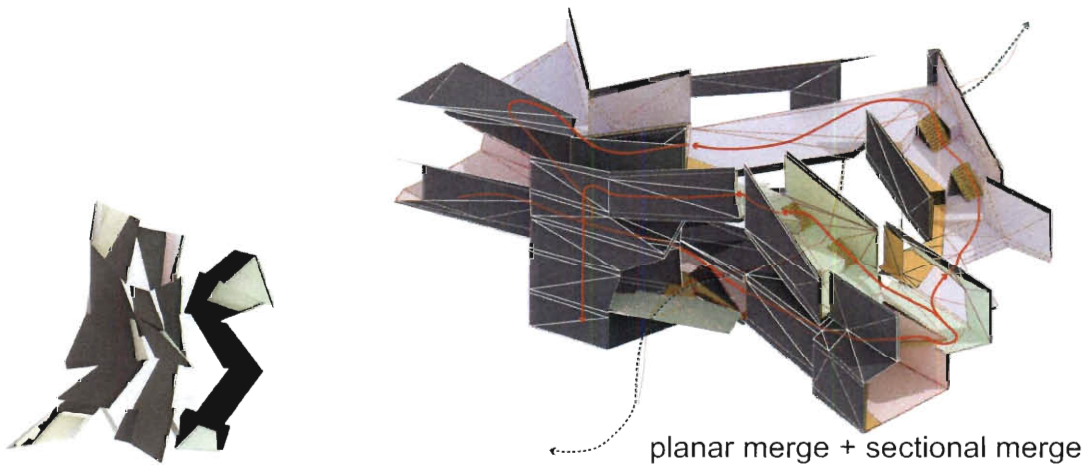


skin study

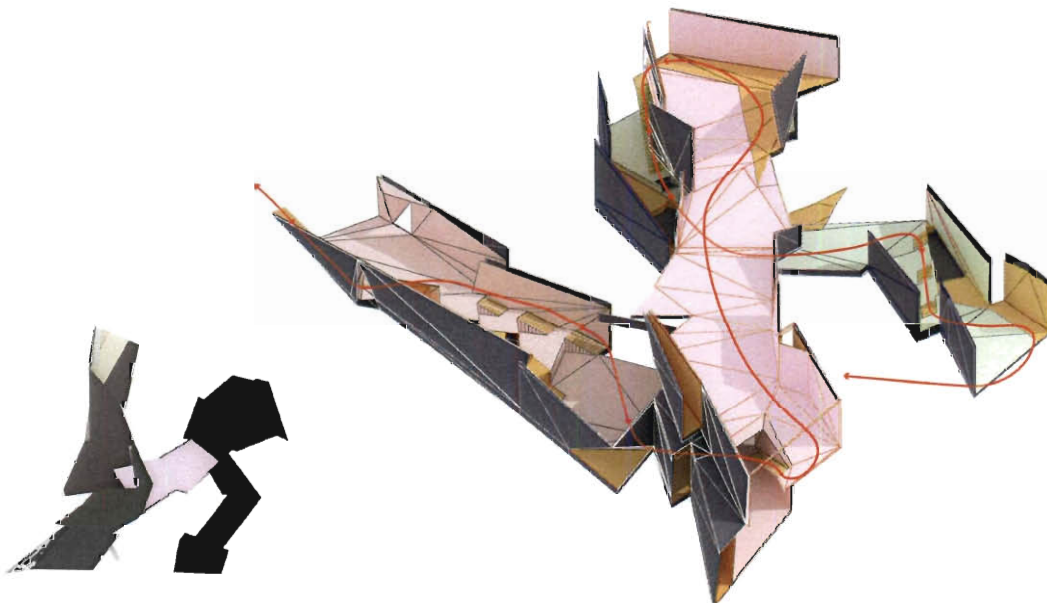
Combinations of the Prototypes



(planar + sectional) (merge + crossing)



planar merge + sectional merge



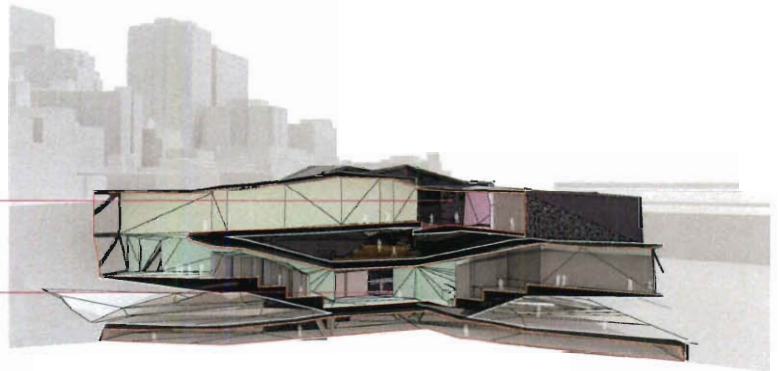
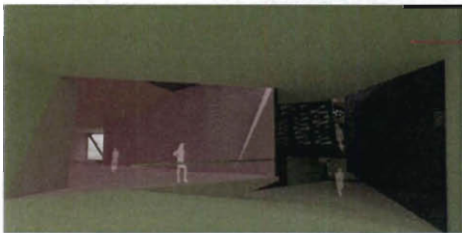
sectional merge + sectional merge

Sectional Development

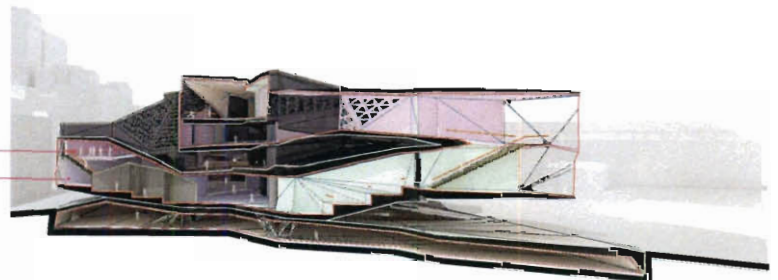
48



Section F-G



Section A-B



Section A-D

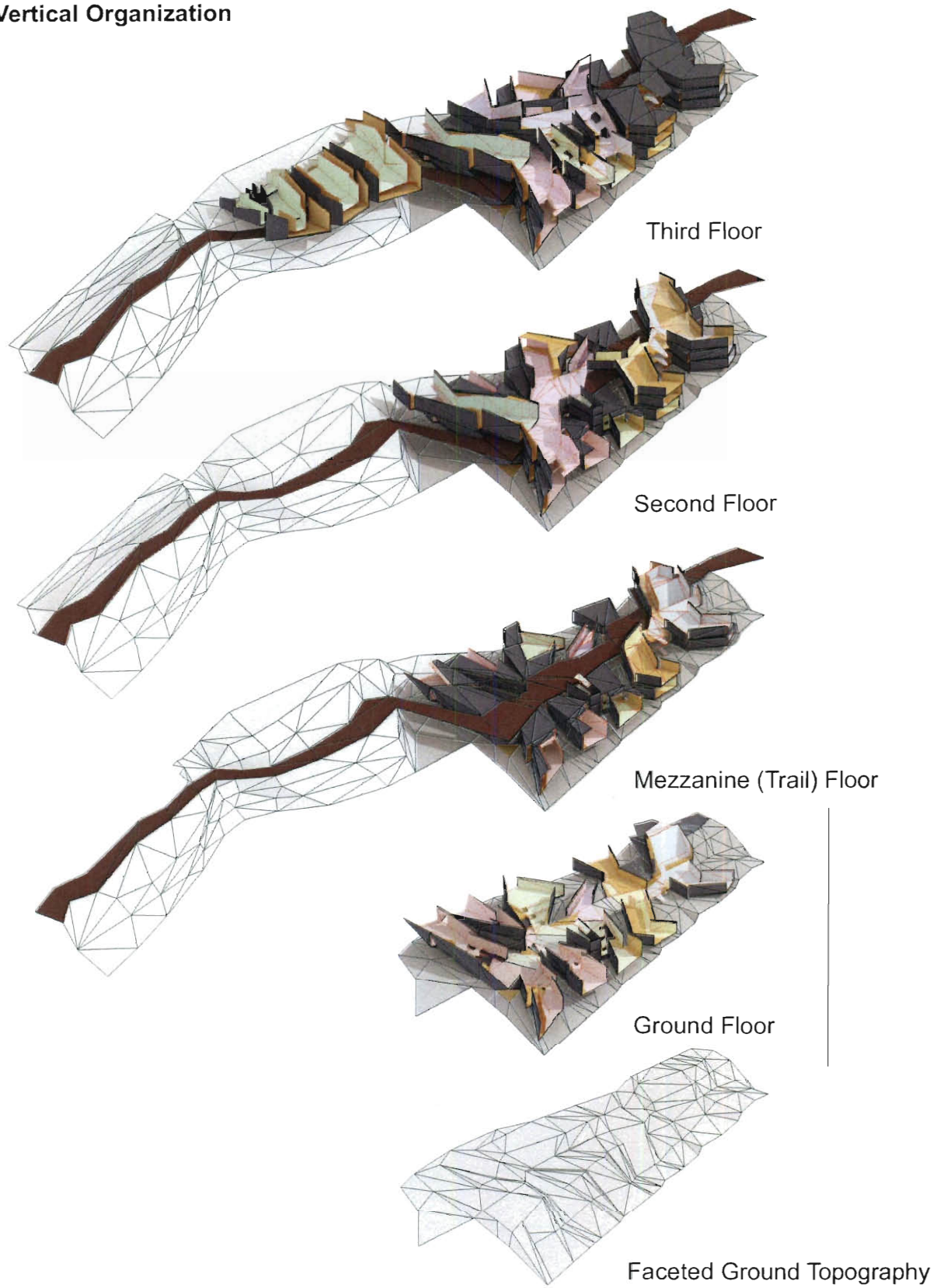


Section C-E



Section Facade Toward Elliot Bay

Vertical Organization

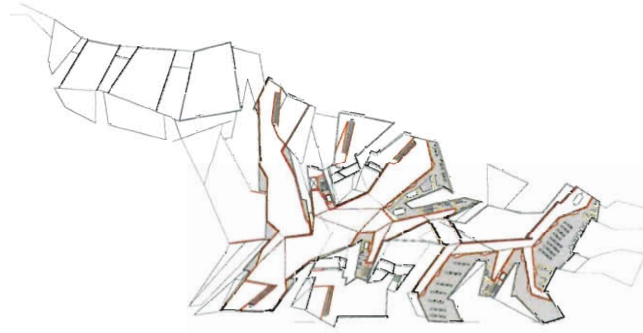


Plans

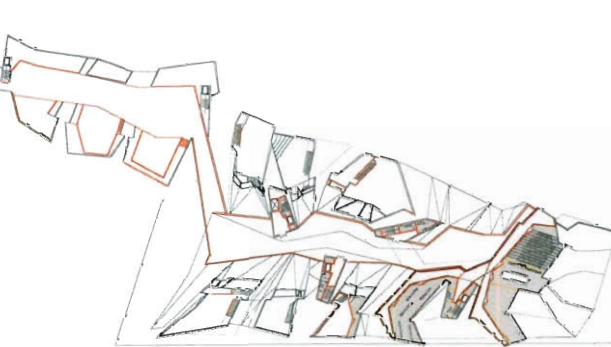
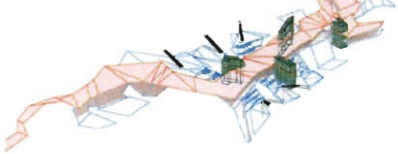
Third Floor



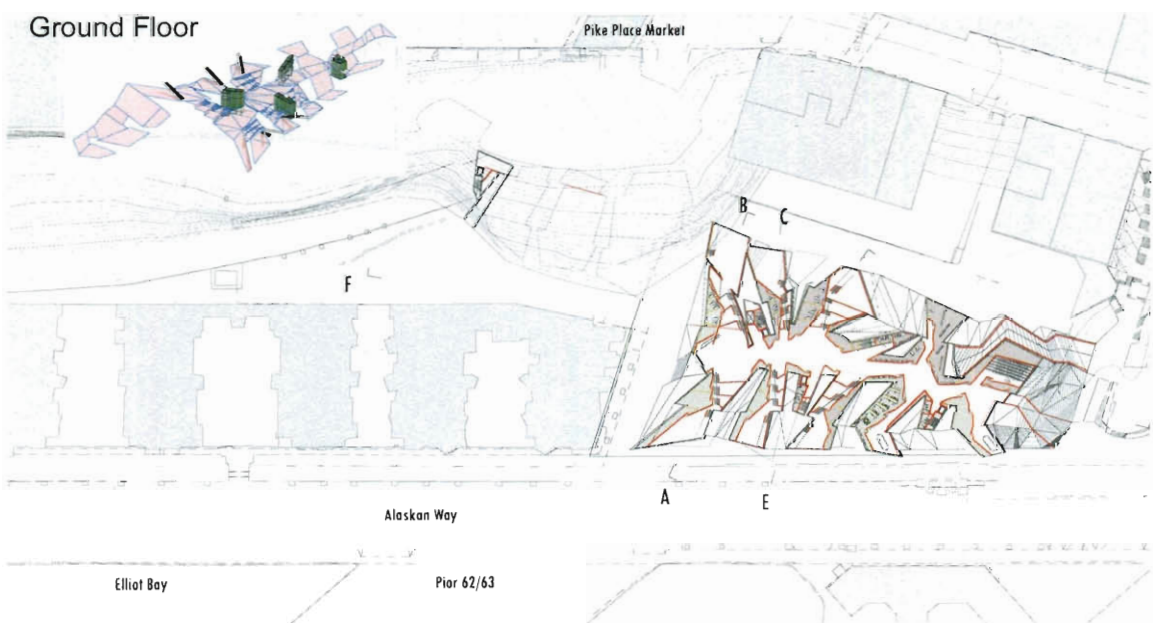
Second Floor



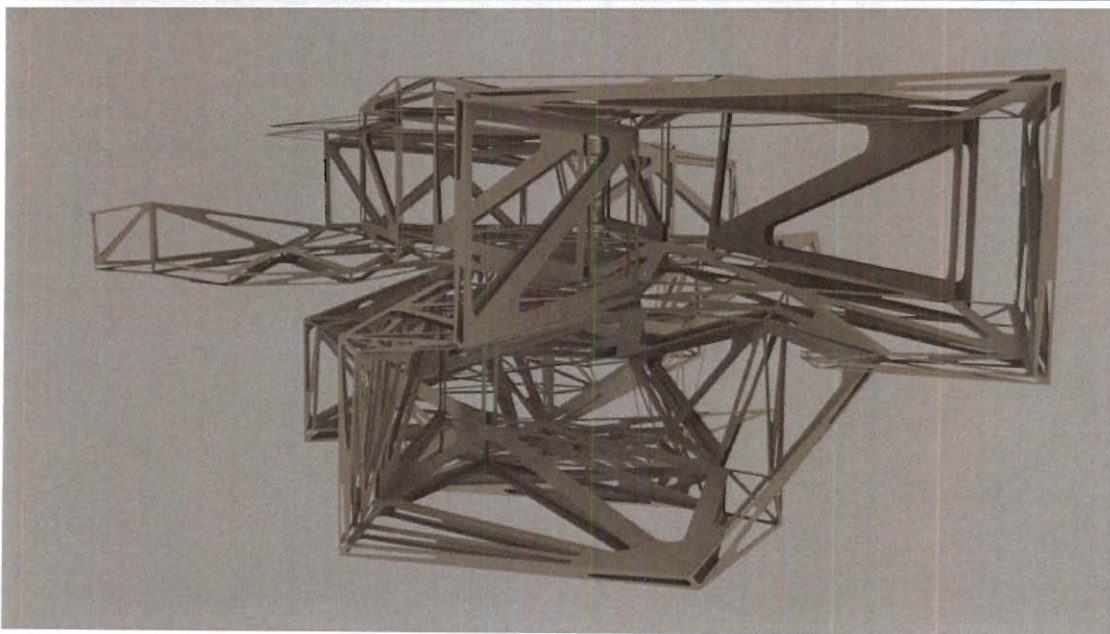
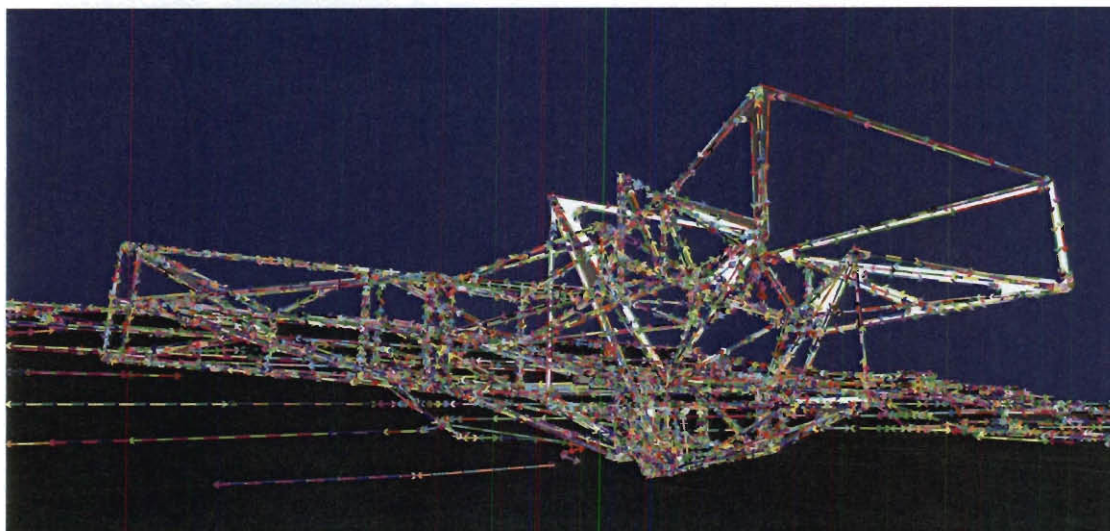
Mezzanine Floor



Ground Floor



APPENDIX: DRAWINGS

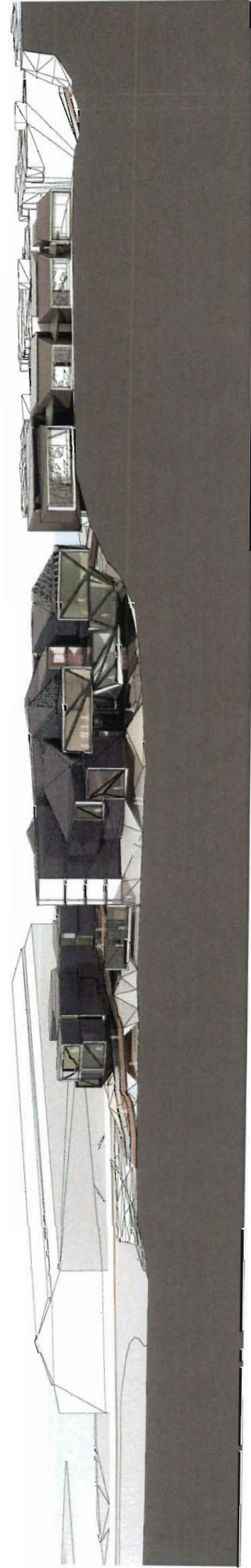


Structural Systems

Sections



Section F-G



Section Facade Toward Elliot Bay



Section A-B

Section A-D



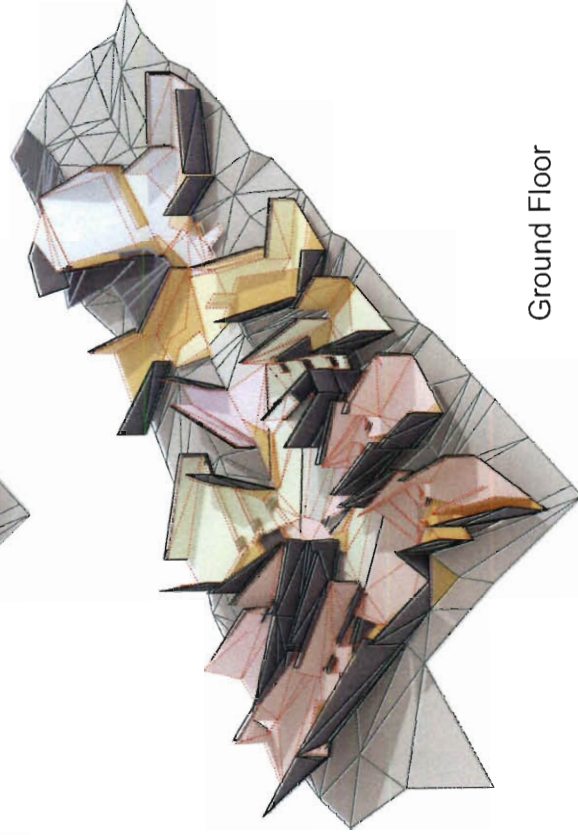
Section C-E



Vertical Organization



Mezzanine (Trail) Floor



Ground Floor



Plans

F

B

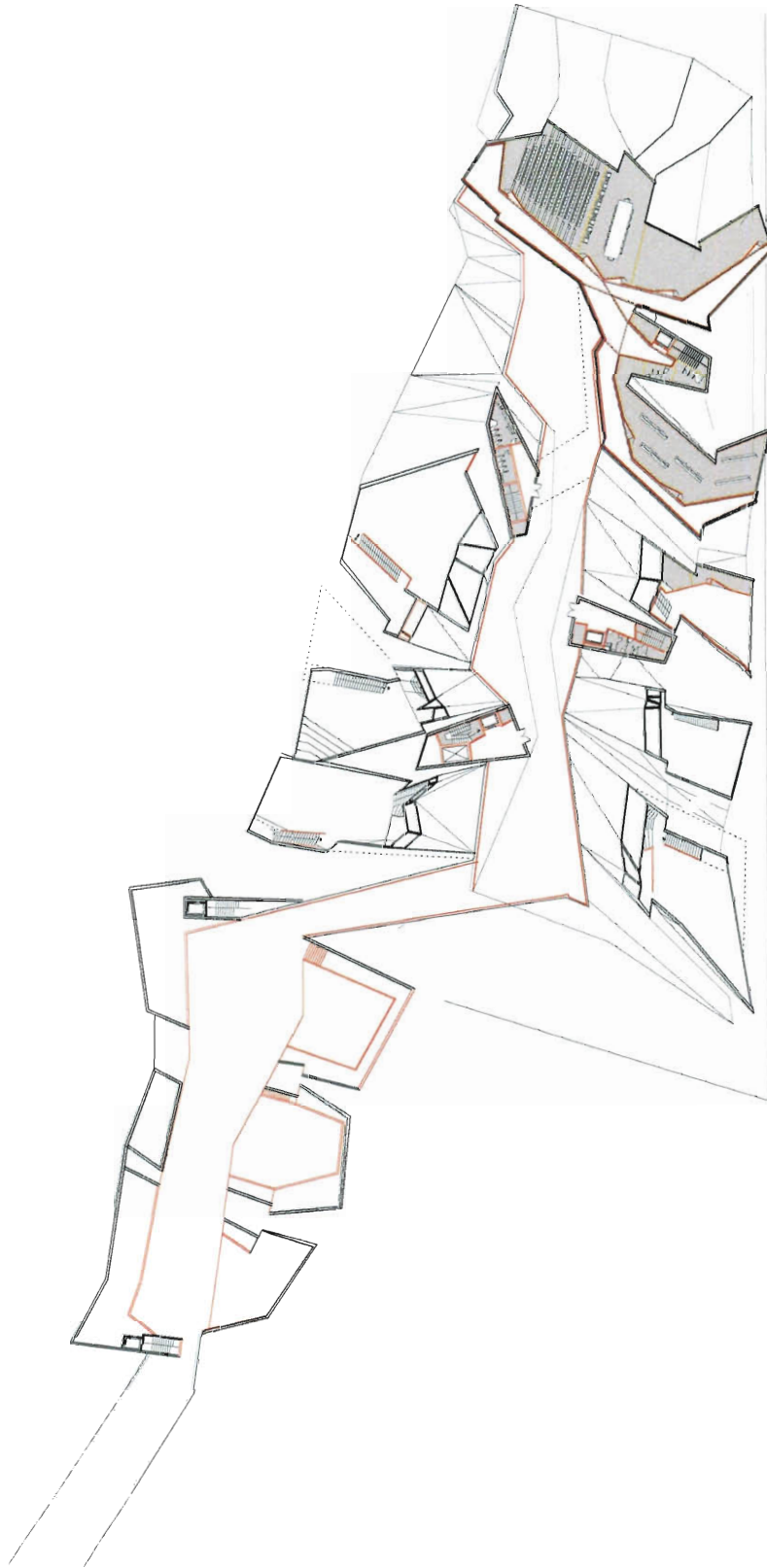
C

D

A

E

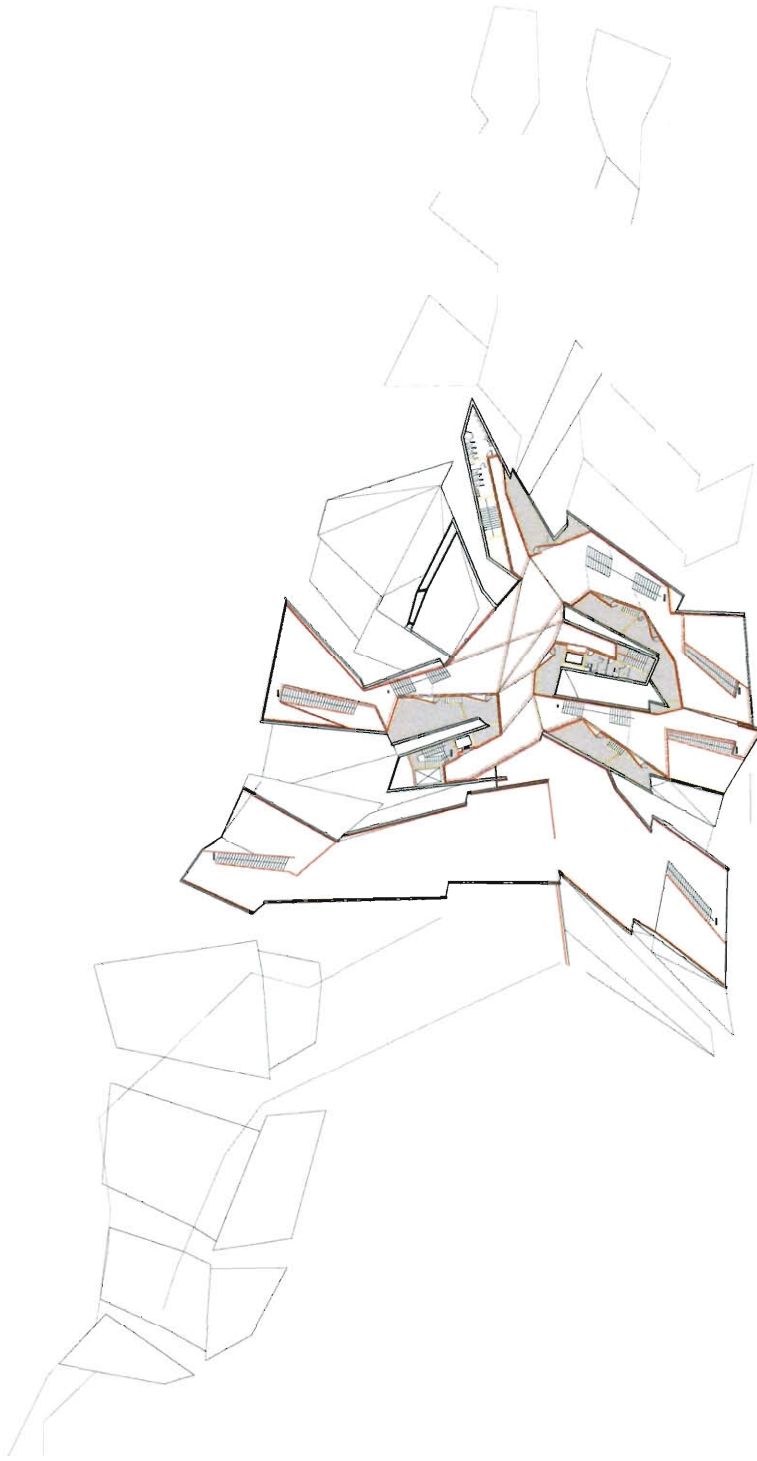
Ground Floor



Mezzanine Floor

Second Floor



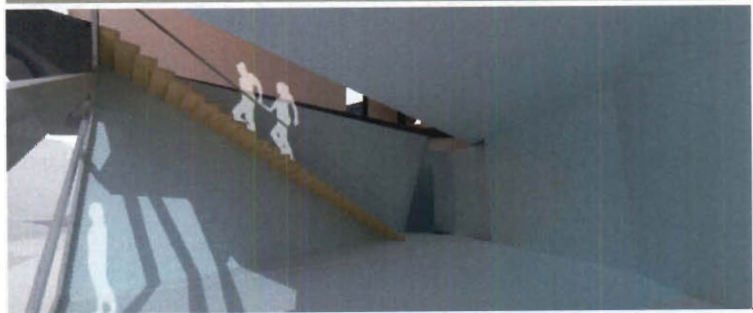
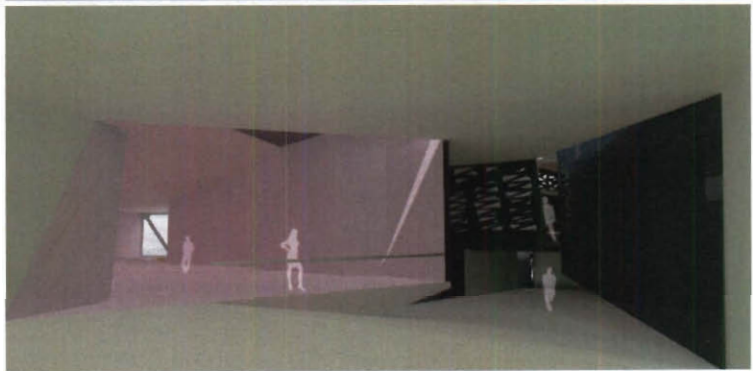
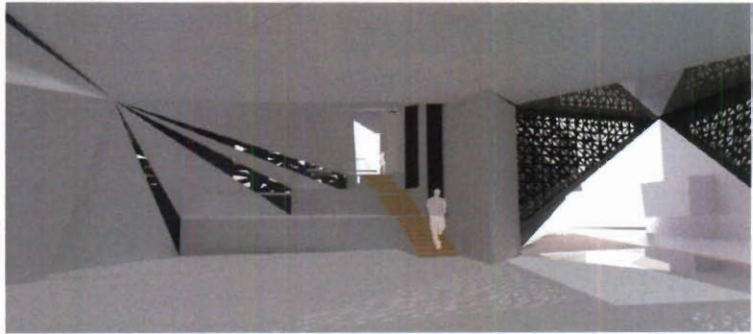


Third Floor

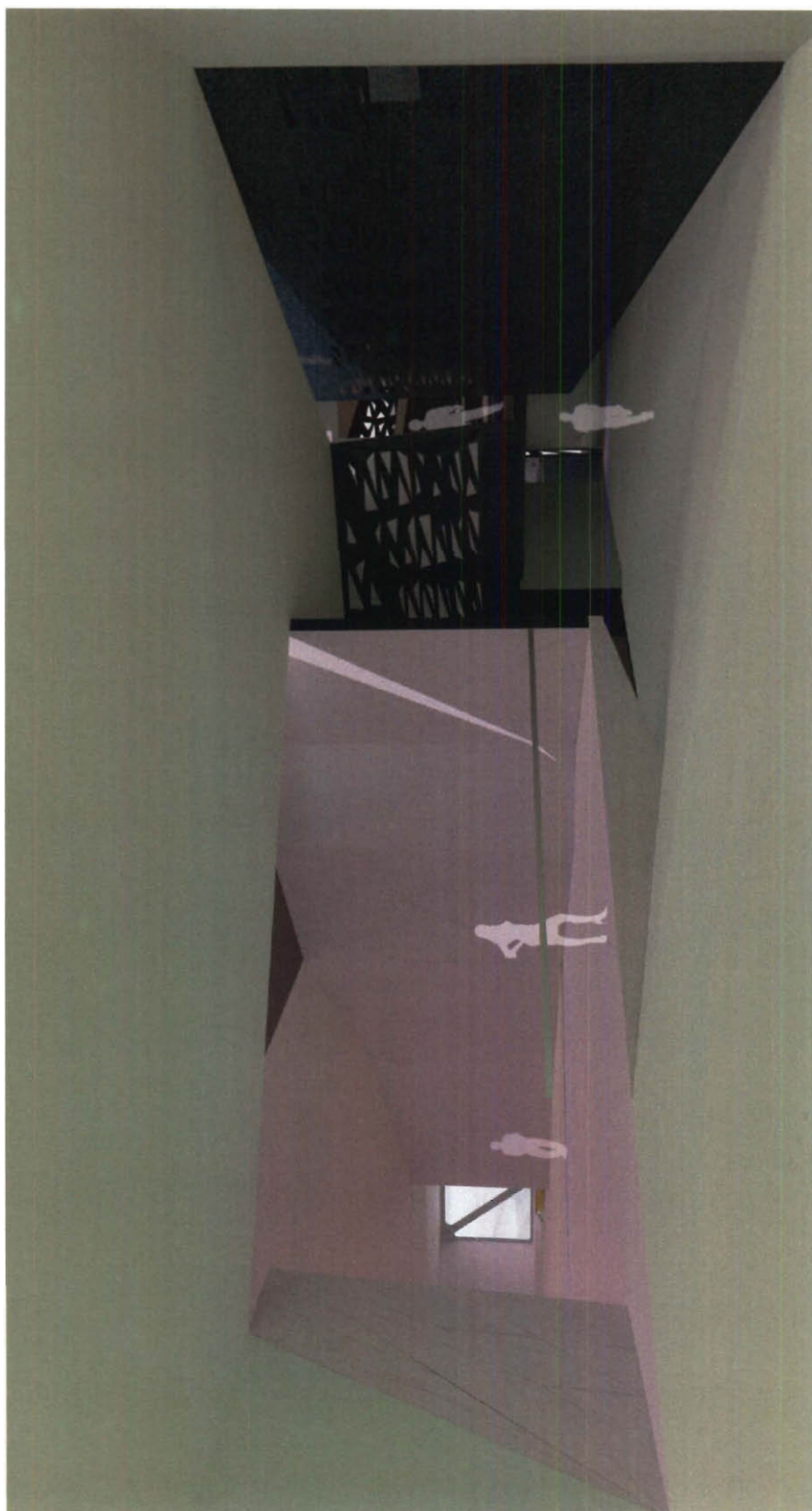
RENDERINGS

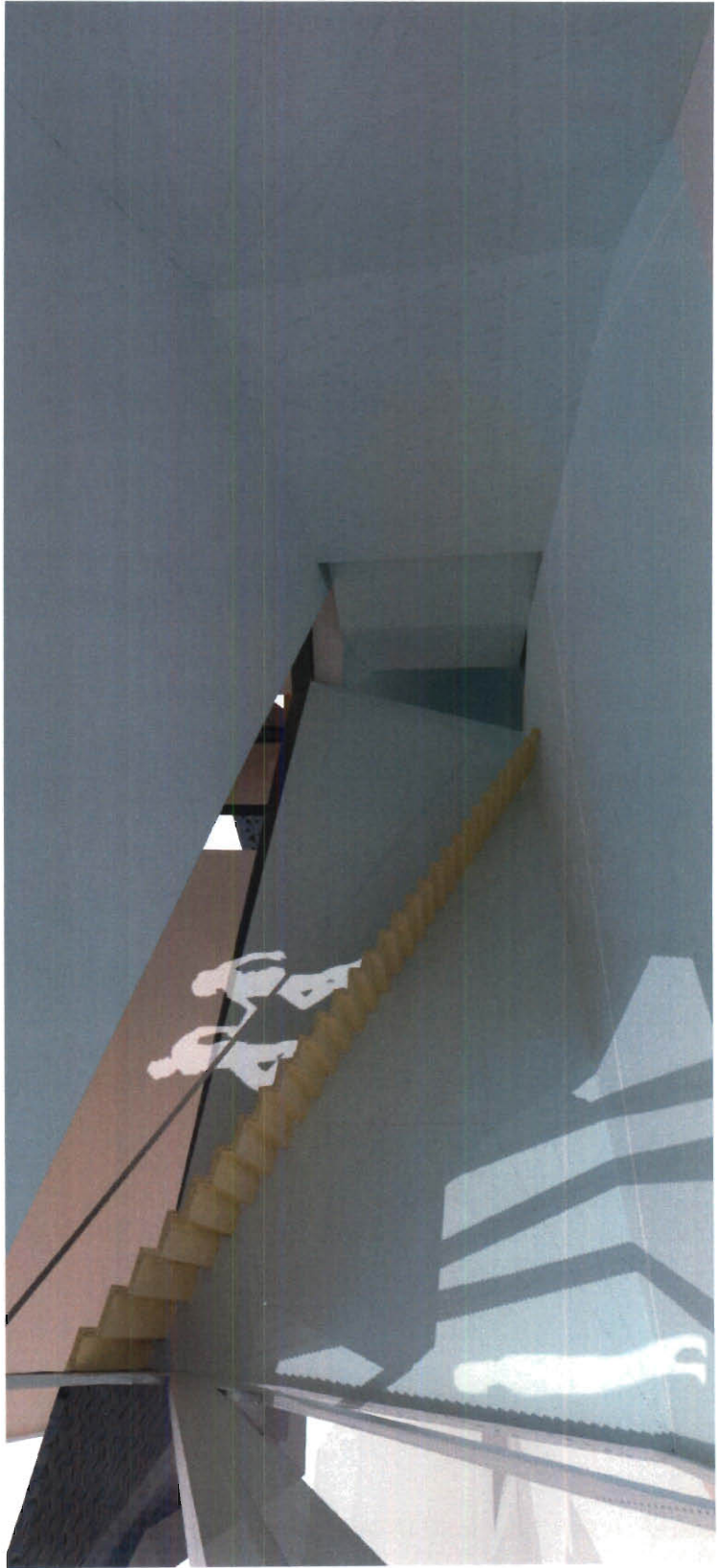
Joints Renderings

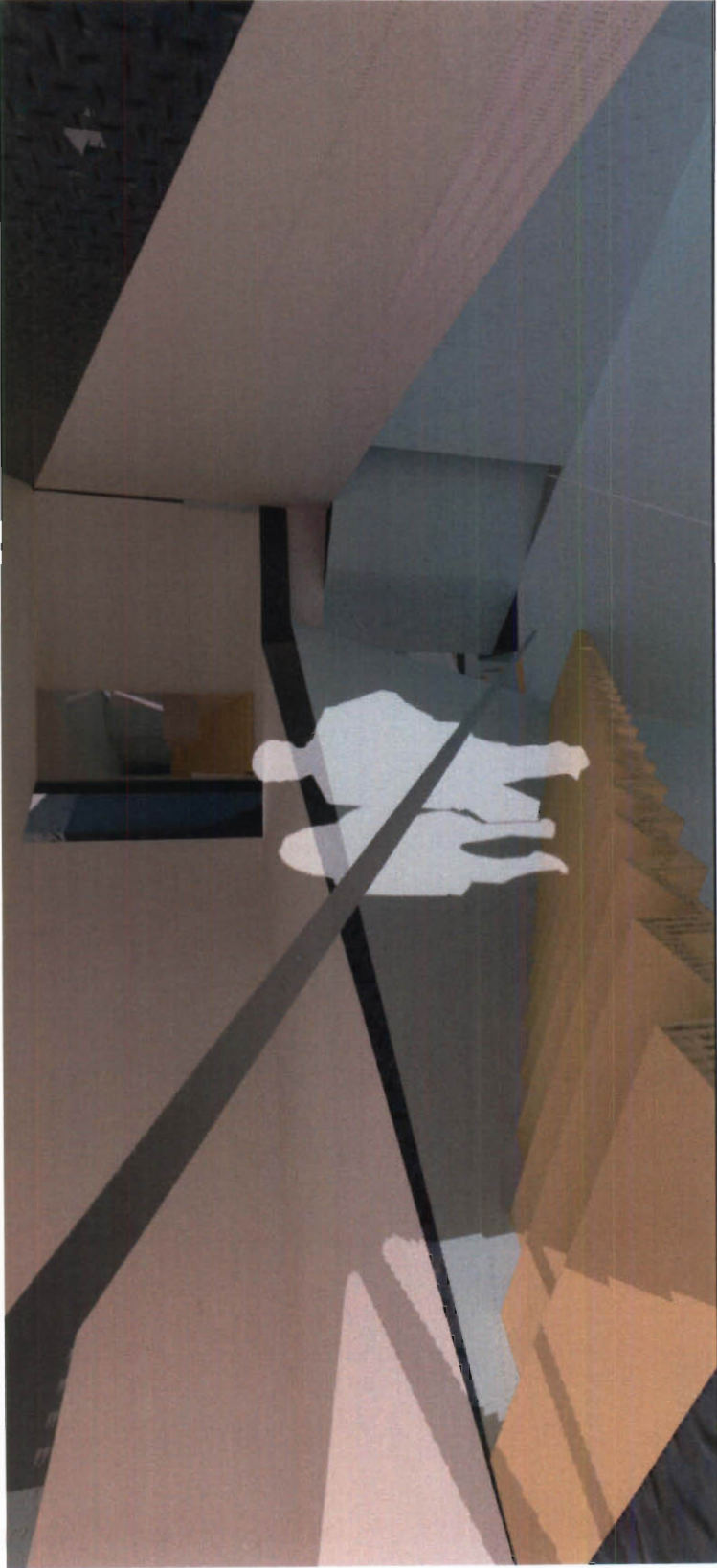
Spatial Experience of
Compound of Objects
and Vectors









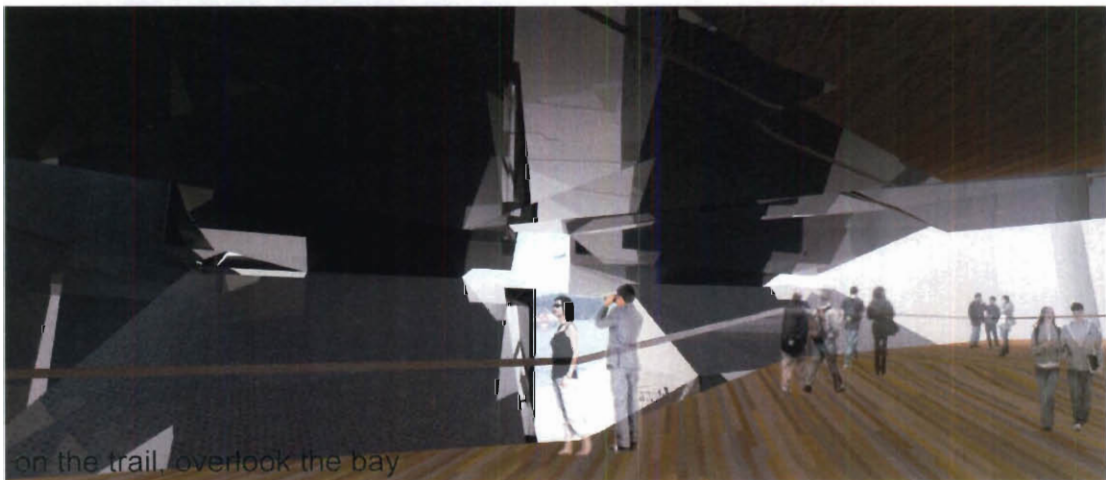




Exterior Renderings

On the trail,

Beneath the building.





overlook from Pike place market

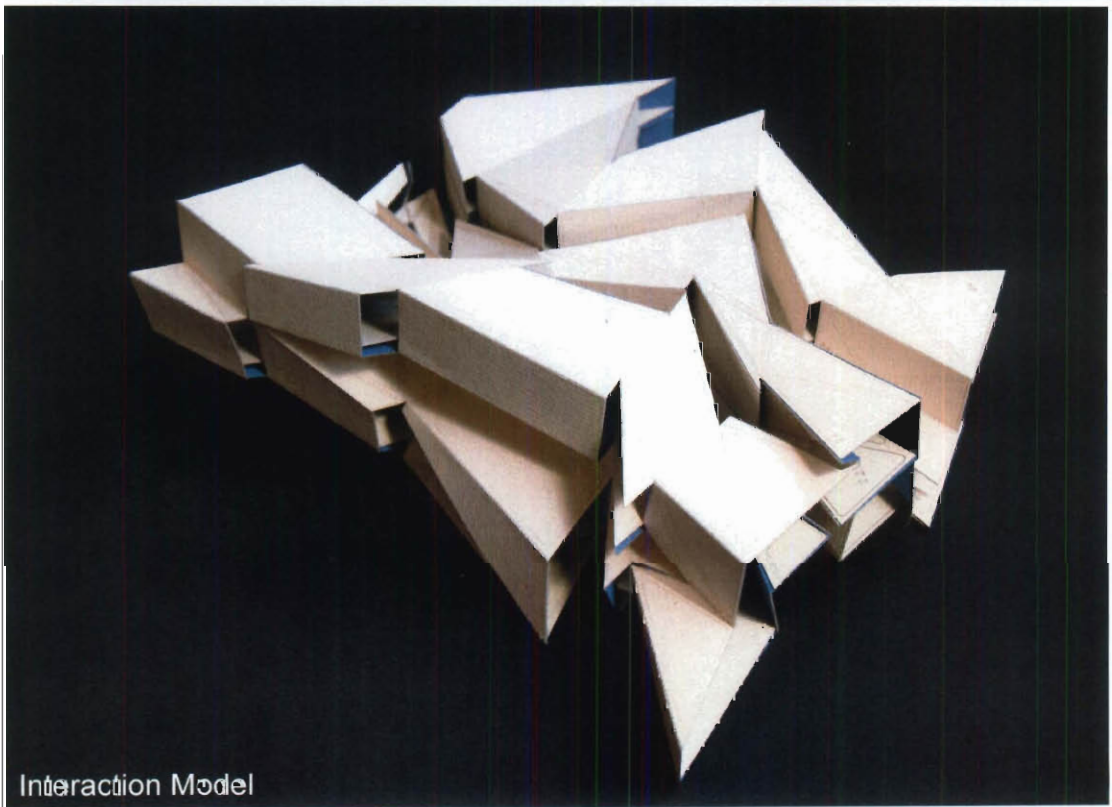
Alaskan Way Street Facade



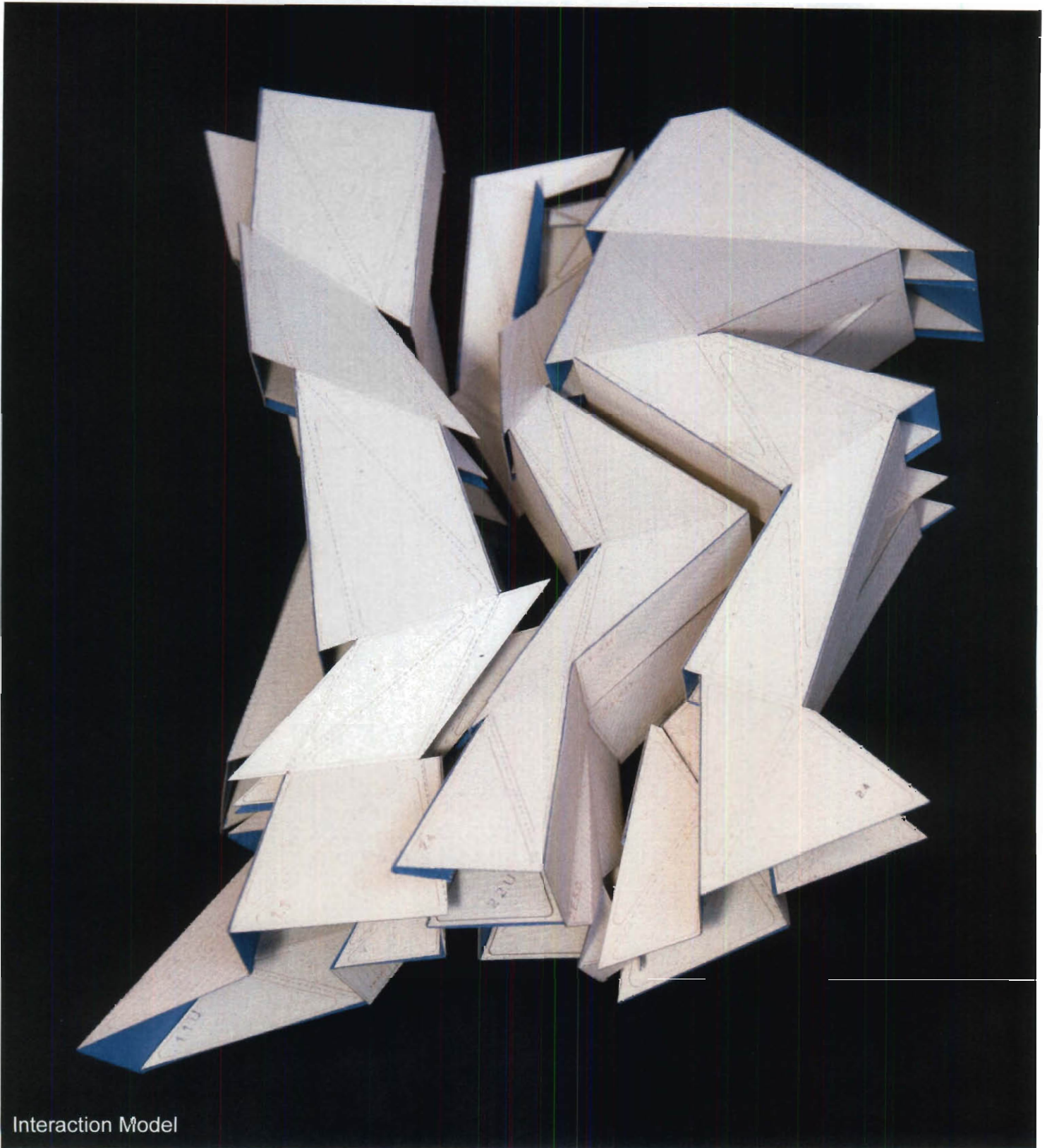


Advisor: Mark Wamble, Rice University

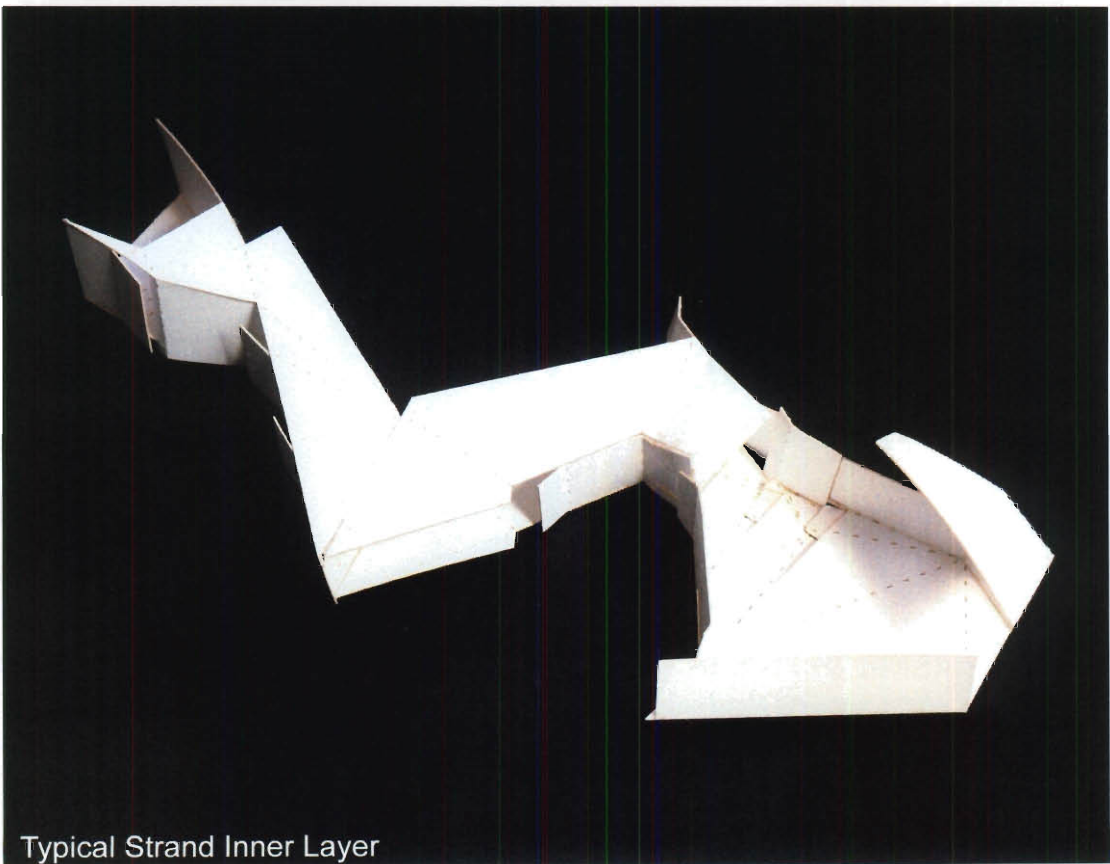
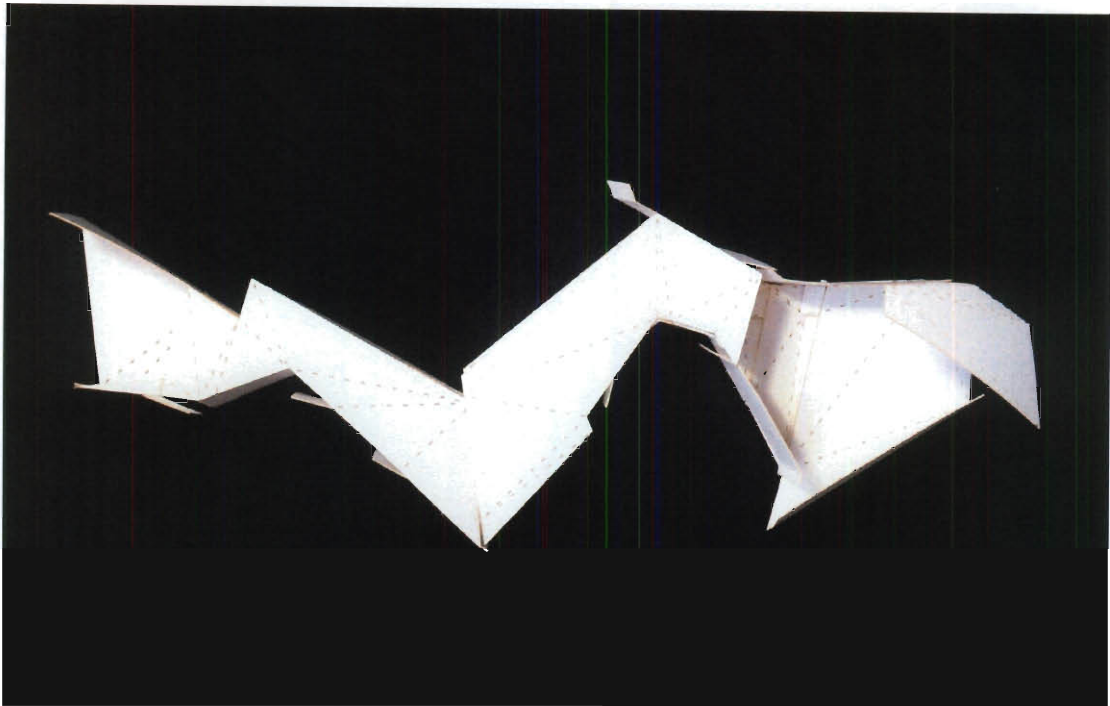
RESEARCHING MODELS



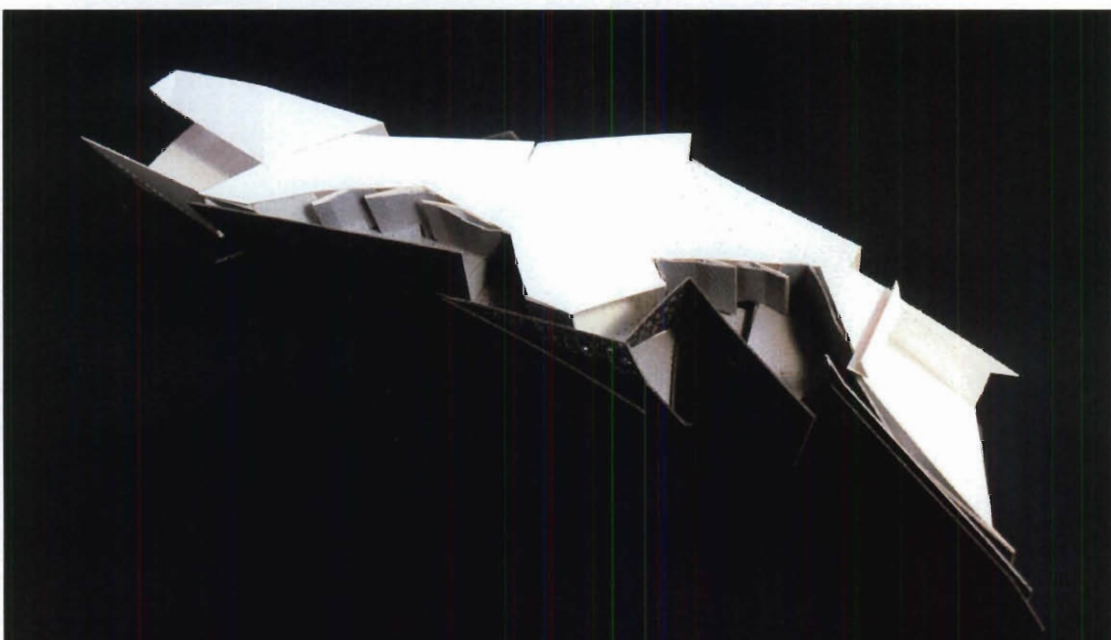
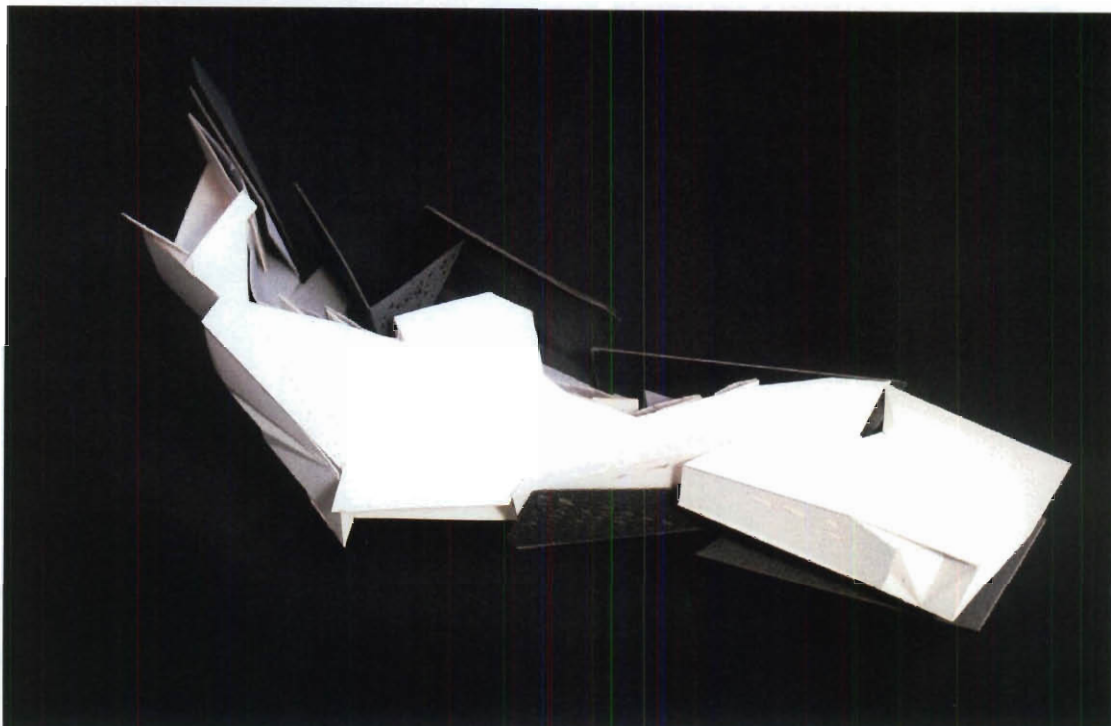
Interaction Model



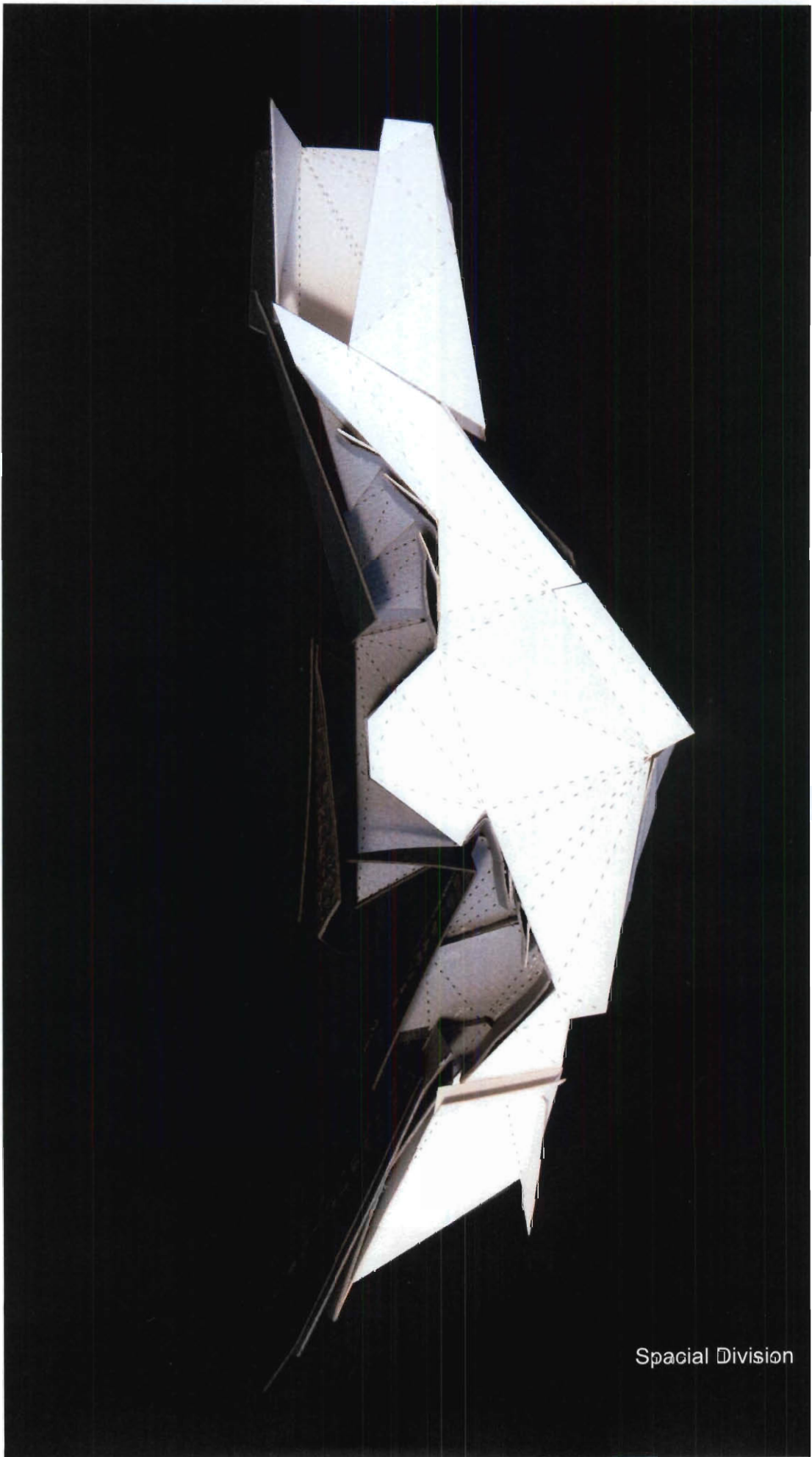
Interaction Model



Typical Strand Inner Layer



Typical Strand Composite Model



Spacial Division

BIBLIOGRAPHY

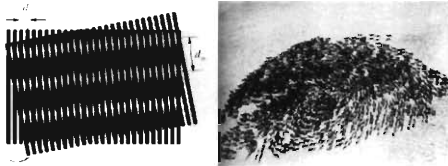
Kwinter, Sanford. "Physical Theory and Modernity: Einstein, Boccioni, Sant' Elia", Architecture of Time. Cambridge: The MIT Press, 2001

By concluding futurism and Boccioni's art works, Sanford introduces how field theory in science influenced philosophy and art, and uses a chapter to discuss field as a new potential for architecture, which is the starting point of the research referring field in architecture.



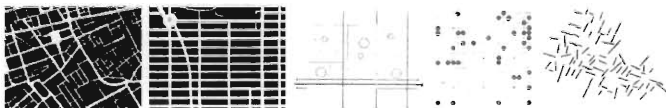
Alan, Stan, "Field Operation", Points and Lines. New York: Princeton Architectural Press, 1999

By quoting Kwinter's "Field Theory", Stan Allen tries to develop practical application of this new concept, and he mainly discusses two points, the moiré patterns and the flocks, respectively representative for object field and vector field. His practice of his own field theory on the competition project for Korean-American Museum of Art in Los Angeles is a core precedence for object field.



Hesel, Michael, Hight, Christopher, and Menges, Achim, "Towards a discourse on Heterogeneous Space-Time and Post-Modernist Social Geography", Space Reader, Heterogeneous Space in Architecture, pp. 9-38, John Wiley & Sons Ltd, United Kingdom 2009.

This book is my main reference for the critic that "object field is still figure-ground pattern". As an abstract of this book, the article compared different theories on field and space historically, and specifically discusses the field heterogeneity mainly based on Albert Pope and Stan Allen's writings. For the authors argue the small differences of the constituent parts of an "object field" is questionable to amount heterogeneity in urban scale, I generalize the argument as "object field only works in certain comparative scale". They also pointed out that the immaterial forces and parameters favoured by Allen and Kwinter are bounded back by architecture to the material objects, which not just supports my critic on Allen (his work is object field though he suggests some subordinate vectors), but also doubts the stability of pure immaterial vector field.



Pope, Albert, "Mass Absense", Ladders, pp.228-237, Rice University School of Architecture 1996,

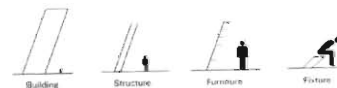
Pope, Albert, "The Reinvention of Space and the Space of Reinvention"(2008) Space Reader, Heterogeneous Space in Architecture, pp. 9-38, John Wiley & Sons Ltd, United Kingdom 2009.

This article, especially the updated part in 2008, inspired me on the critic of some vector-algorithmic dominated continuous-surface projects. In the last paragraphs, Pope questioned whether the revival of public life begins from urban space, and speculates the invention of space follows an invention of the subject, which infers the importance of materiality for urban space. If juxtaposing the Image showing the Fascism Mass Demonstration in front the Casa del Fascio, cited by Pope, with the rendering of R+M's West Side Convergence project, I find they are to some extent very similar, which is evident for my argument that these parametric continuous surfaces started from pure vector calculations are still modernism shed, or, another version of Domino.



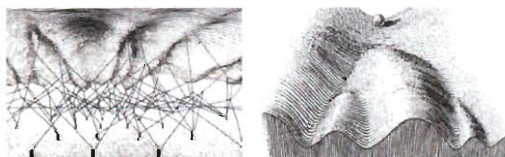
Reiser, Jesse and Umemoto, Nanako, Atlas of Novel Tectonics. New York: Princeton Architectural Press, 2006

This book is a general reference for me to understand the contemporary thought of heterogeneity, part to whole relationship, and the dialectics between same and difference, matter and energy, exact and inexact. In the last part of the book they proposes the neo-regionalism, which requires another level of mixture that doesn't erases difference, but create new kinds of difference as a compound, which is helpful for my thesis topic. I also find a lot arguments in this book can be used to critic the author's own projects, for example, when they criticize the abuse of diagram in architecture on page 223, with which I agree, I also argues the abuse of vectors in many similar infrastructural projects.



Kwinter, Sanford, "Landscape of Change: Boccioni's Stati d'animo as a General Theory of Models", Assemblage 19, pp.50-65, the MIT Press, Dec 1992

This article is a reference for better understanding morphogenetics, which records more information and offers more potential than the reductionism models. Kwinter's discuss on epigenetic landscape



I argue that the bottom side of the model to the left carries more potential than the top surface to the right

also explained how vector field works and transforms vectors into continuous surface. However, by compare the the top and bottom of the epigenetic model, I doubt which one is more productive, or provide more potential for architecture.

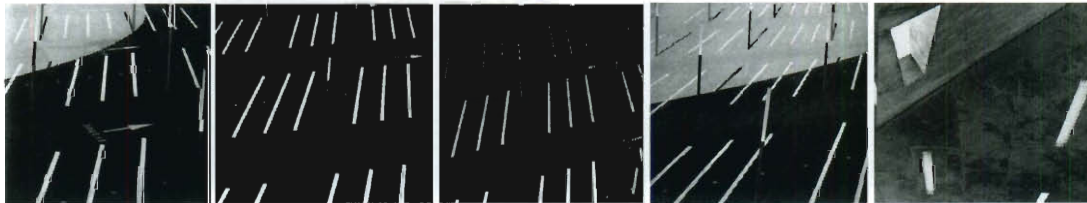
Hadid, Zaha, GA Document Extra: Zaha M. Hadid 03, 1995 A.D.A Tokyo Co., Ltd.

In this book Hadid talks about her design philosophy and major early works with the GA interviewer, including Vitra Fire Station, a very important precedence for me. She emphasizes her interests in mathematics and art, and how these interests contribute to her strong geometric operation capacity and sensitivity. For Vitra Fire Station, Zaha discusses her intention to make the space in the most fluid way possible, and to make people see everything in the interior; she also wants the shed to be light and transformable from a closed room into an open roof, in order to make the space of inside flow into the outside. Based on these texts, I conclude her intention as to vectorize the roofs and surfaces.



Ruby, Andreas, "Ground Graffiti", Zaha Hadid: Car Park and Terminus Strasbourg, Lars Muller Publishers, Switzerland 2004

In this article the author analyzes Hadid's Strasbourg project and refers to several important points for my thesis arguments. He states that the overall concept of the project is one of overlapping fields and lines that form a constantly shifting whole, and most important of all, he clarified that the fields is constituted by patterns of movement produced by cars, trams, bicycles and pedestrians, each of which has a trajectory as well as a static component. Though the vectors of the pedestrians are not dominant, they are legible under the platform roof as well as on the parking ground; the movement patterns are both trajectories and static components, which is just an instance of the compound field I proposed.



Schumacher, Patrik, "The Prehistory of the New Digitally Based Architecture", Digital Hadid, Birkhäuser Architecture 2000

This article is important for its discussion on the necessity of advanced digital software in the discursive formation of architecture. According to Schumacher, Hadid's early elaborate techniques of projective distortion and intention to gather a multitude of elements into one geometric force field, which were not related to digital technology at all, are the decisive factor for their office and the Hadid style forms. The earlier practice of Hadid sets the precedence of the current computer based techniques of deformation and the modeling of the fields, therefore, the adoption of advanced animation tools need to be prepared by certain conceptual and methodological advances that preceded the arrival of these tools. Inspired by these statements, I will focus more on the concepts and methodologies of my compound field before experiment them with software.



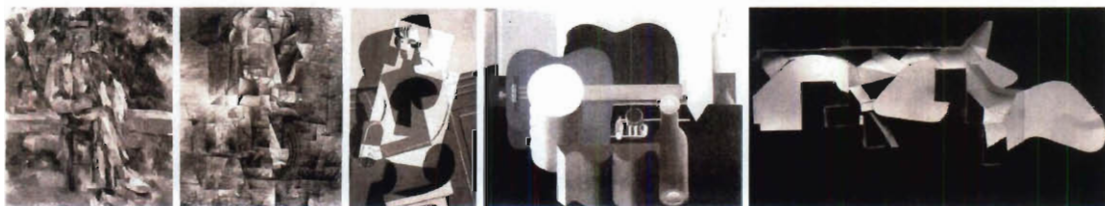
Curtis, William J.R., "Mental Maps And Social Landscapes", *El Croquis* #30+49/50+72(11)+100/101: Enric Miralles 1983 - 2000, Madrid 2005

This is a important essay article for my argument of "Materialized Vectors". Curtis concludes the main elements and operations of Enric Miralles' formal operations and mentions several important points of their vector qualities in his early cooperation with Carme Pinós. He points out Miralles's particular intersts in tilted plans, floating horizontals, stratified sections, inflected fragments, ambiguous relationship between figure and ground and bold geometrical incision or diagonal accents in his plans; the ramps, bridges, platforms, galleries, stairs, decks, benches, steps, railings and other components, which directly related to human use and movement, are dramatized to interpenetrate and interconnect, to insure tension between building and setting and break down institutional barriers.



Quetglas, Josep, "Don't Be Deluded", *El Croquis* #30+49/50+72(11)+100/101: Enric Miralles 1983 - 2000, Madrid 2005

The author compared Miralles' architecture with Le Corbusier and Albert Viaplana (in whose office Miralles started his practice) by associating the comparison between paintings of Paul Cézanne, Pablo Picasso, Juan Gris and Le Corbusier. He criticizes Juan Gris only studied "Cézanne Post-card" while Picasso actually studied Cézanne, and pointed out Miralles is opposed to Viaplana and Corbusier just as Gris to Picasso. For Miralles, his architecture has no single element that can be pointed out, architecture appears prior to the existence of vocabulary applied to each of its parts, which is the supremely natural way of making architecture.



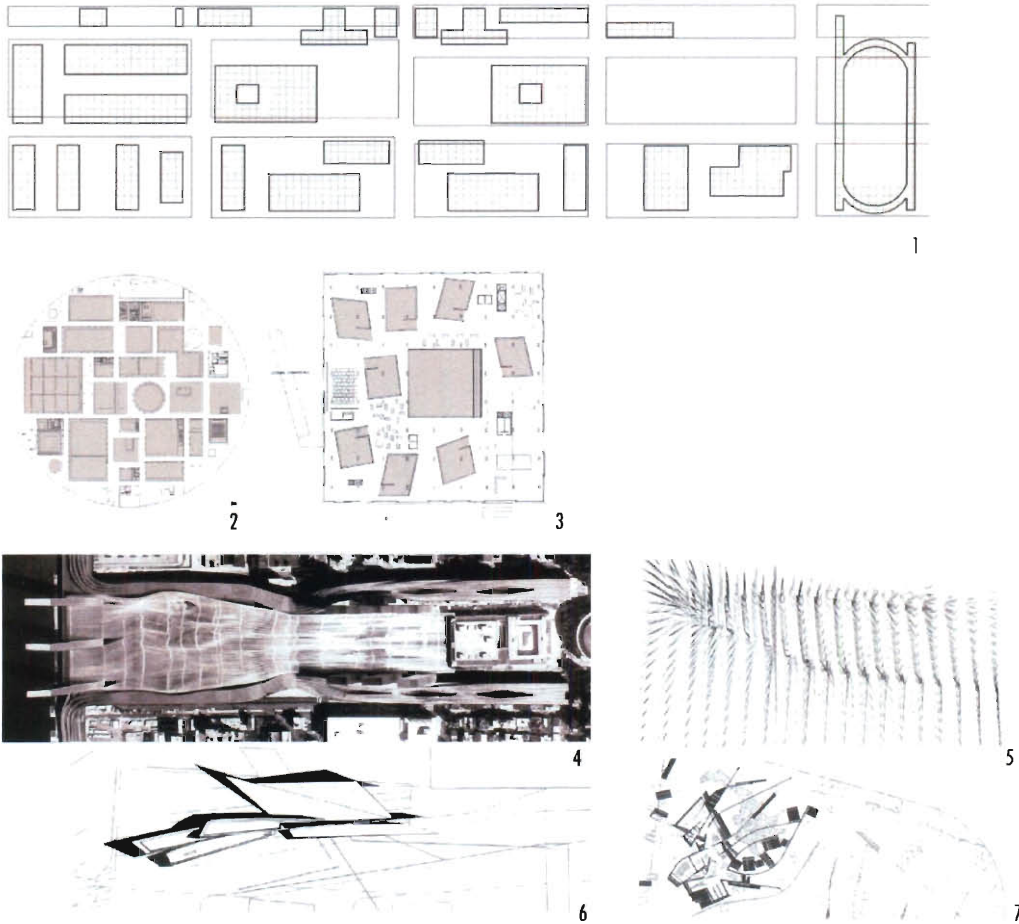
Zaera, Alejandro, "A Coversation with Enric Miralles" (1995), *El Croquis* #30+49/50+72(11)+100/101: Enric Miralles 1983 - 2000, Madrid 2005

In this interview by Zaera, Miralles revealed some mature thoughts on both force field and the materialization of ideas: He considers the people moving around the building or moving through the walls and pillars as a field of forces, which accounts for part of the building's weight; he argues that the minimalism works in art but not architecture, in which ideas do not exist before their materializa-



tion, and that construction process should not be determined by either an origin or an end. An influential part for me is that He criticizes the static attitude implied by the minimalist principles does not appear to determine the type of operations that they have been proposing.

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3. Alan, Stan, Korean-American Museum of Art, competition entry, Los Angeles, 1999
4. Reiser, Jesse and Umemoto, Nanako, West Side Convergence Competition Entry, New York 1999.
5. Rahim, Ali, Reebook Shanghai Flag Store, Shanghai, China 2004
6. Hadid, Zaha, Vitra Fire Station, Weil am Rhein, Germany 1990-1993
7. Miralles Enric (EMBT), Palafolls Public Library, Barcelona, Spain 1997